FLOOD INSURANCE STUDY

FEDERAL EMERGENCY MANAGEMENT AGENCY

VOLUME 1 OF 3

MENDOCINO COUNTY, CALIFORNIA

AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
FORT BRAGG, CITY OF	060184
MENDOCINO COUNTY UNINCORPORATED AREAS	060183
PINOLEVILLE INDIAN RESERVATION	060058
POINT ARENA, CITY OF	060185
UKIAH, CITY OF	060186
WILLITS, CITY OF	060187

FEMA

PRELIMINARY

SEP 14, 2015

REVISED:

FLOOD INSURANCE STUDY NUMBER
06045CV001B

Version Number 2.3.2.0

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Published Separately

FLOOD INSURANCE STUDY REPORT
MENDOCINO COUNTY, CALIFORNIA

SECTION 1.0 – INTRODUCTION

1.1 The National Flood Insurance Program

The National Flood Insurance Program (NFIP) is a voluntary Federal program that enables property owners in participating communities to purchase insurance protection against losses from flooding. This insurance is designed to provide an insurance alternative to disaster assistance to meet the escalating costs of repairing damage to buildings and their contents caused by floods.

For decades, the national response to flood disasters was generally limited to constructing flood-control works such as dams, levees, sea-walls, and the like, and providing disaster relief to flood victims. This approach did not reduce losses nor did it discourage unwise development. In some instances, it may have actually encouraged additional development. To compound the problem, the public generally could not buy flood coverage from insurance companies, and building techniques to reduce flood damage were often overlooked.

In the face of mounting flood losses and escalating costs of disaster relief to the general taxpayers, the U.S. Congress created the NFIP. The intent was to reduce future flood damage through community floodplain management ordinances, and provide protection for property owners against potential losses through an insurance mechanism that requires a premium to be paid for the protection.

The U.S. Congress established the NFIP on August 1, 1968, with the passage of the National Flood Insurance Act of 1968. The NFIP was broadened and modified with the passage of the Flood Disaster Protection Act of 1973 and other legislative measures. It was further modified by the National Flood Insurance Reform Act of 1994 and the Flood Insurance Reform Act of 2004. The NFIP is administered by the Federal Emergency Management Agency (FEMA), which is a component of the Department of Homeland Security (DHS).

Participation in the NFIP is based on an agreement between local communities and the Federal Government. If a community adopts and enforces floodplain management regulations to reduce future flood risks to new construction and substantially improved structures in Special Flood Hazard Areas (SFHAs), the Federal Government will make flood insurance available within the community as a financial protection against flood losses. The community's floodplain management regulations must meet or exceed criteria established in accordance with Title 44 Code of Federal Regulations (CFR) Part 60.3, *Criteria for land Management and Use*.

SFHAs are delineated on the community's Flood Insurance Rate Maps (FIRMs). Under the NFIP, buildings that were built before the flood hazard was identified on the community's FIRMs are generally referred to as "Pre-FIRM" buildings. When the NFIP was created, the U.S. Congress recognized that insurance for Pre-FIRM buildings would be prohibitively expensive if the premiums were not subsidized by the Federal Government. Congress also recognized that most of these floodprone buildings were built by individuals who did not have sufficient knowledge of the flood hazard to make informed decisions. The NFIP requires that full actuarial rates reflecting the complete flood risk be charged on all buildings constructed or substantially improved on or after the effective date of the initial FIRM for the community or after December 31, 1974, whichever is later. These buildings are generally referred to as "Post-FIRM" buildings.

1.2 Purpose of this Flood Insurance Study Report

This Flood Insurance Study (FIS) report revises and updates information on the existence and severity of flood hazards for the study area. The studies described in this report developed flood hazard data that will be used to establish actuarial flood insurance rates and to assist communities in efforts to implement sound floodplain management.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive than the minimum Federal requirements. Contact your State NFIP Coordinator to ensure that any higher State standards are included in the community's regulations.

1.3 Jurisdictions Included in the Flood Insurance Study Project

This FIS Report covers the entire geographic area of Mendocino County, California.

The jurisdictions that are included in this project area, along with the Community Identification Number (CID) for each community and the 8-digit Hydrologic Unit Codes (HUC-8) sub-basins affecting each, are shown in Table 1. The Flood Insurance Rate Map (FIRM) panel numbers that affect each community are listed. If the flood hazard data for the community is not included in this FIS Report, the location of that data is identified.

The location of flood hazard data for participating communities in multiple jurisdictions is also indicated in the table.

Jurisdictions that have no identified SFHAs as of the effective date of this study are indicated in the table. Changed conditions in these communities (such as urbanization or annexation) or the availability of new scientific or technical data about flood hazards could make it necessary to determine SFHAs in these jurisdictions in the future.

Table 1: Listing of NFIP Jurisdictions

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Fort Bragg, City of	060184	18010108	06045C1005G 06045C1010G 06045C1015G 06045C1016G	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Mendocino County, Unincorporated Areas	060183	18010103 18010104 18010105 18010106 18010107 18010108 18010109 18010110	06045C0020G 06045C0050F 06045C0075F 06045C0100F 06045C0125F 06045C0135G 06045C0175G 06045C0200F 06045C0225F 06045C0250F 06045C0275F 06045C0300F 06045C0325F 06045C0350F 06045C0375F[1] 06045C0385G 06045C0425G 06045C0450F 06045C0475F 06045C0500F 06045C0517F 06045C0525F 06045C0536F 06045C0550F 06045C0575F 06045C0600F[1] 06045C0625G 06045C0650F 06045C0659F 06045C0667F 06045C0675F 06045C0678F 06045C0686F 06045C0700F 06045C0725F 06045C0750F 06045C0775F 06045C0800F[1] 06045C0810G 06045C0820G	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Mendocino County, Unincorporated Areas	060183	18010103 18010104 18010105 18010106 18010107 18010108 18010109 18010110	06045C0850F 06045C0875F[1] 06045C0900F 06045C0925F 06045C0950F 06045C0975F 06045C1000F[1] 06045C1005G 06045C1010G 06045C1015G 06045C1016G 06045C1017F 06045C1018F 06045C1019F[1] 06045C1050F 06045C1075F[1] 06045C1100F 06045C1111F 06045C1112F 06045C1113F 06045C1114F 06045C1125F 06045C1142F 06045C1144F 06045C1150F 06045C1161F 06045C1163F 06045C1164F 06045C1175F 06045C1200G 06045C1225F 06045C1250F[1] 06045C1275F[1] 06045C1291F 06045C1292F 06045C1293F 06045C1294F 06045C1300F 06045C1313F 06045C1314F	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Mendocino County, Unincorporated Areas	060183	18010103 18010104 18010105 18010106 18010107 18010108 18010109 18010110	06045C1325F 06045C1328F 06045C1336F 06045C1350F 06045C1375F[1] 06045C1385G 06045C1392G 06045C1425G 06045C1450F 06045C1475F 06045C1500F[1] 06045C1501F 06045C1502F 06045C1503F 06045C1504F 06045C1506F 06045C1507F 06045C1508F 06045C1509F 06045C1511F 06045C1512F 06045C1513F 06045C1514F 06045C1516F 06045C1517F 06045C1518F 06045C1519F 06045C1550F 06045C1575F[1] 06045C1600G 06045C1625F 06045C1641F 06045C1642F 06045C1644F 06045C1650F 06045C1659F 06045C1663F 06045C1675F[1] 06045C1676F 06045C1677F	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Mendocino County, Unincorporated Areas	060183	18010103 18010104 18010105 18010106 18010107 18010108 18010109 18010110	06045C1678F 06045C1679F 06045C1681F 06045C1682F[1] 06045C1683F 06045C1684F 06045C1690F 06045C1691F 06045C1692F 06045C1693F[1] 06045C1694F 06045C1711F 06045C1713F 06045C1725F[1] 06045C1740G 06045C1750G 06045C1775F 06045C1800F 06045C1825F 06045C1831F 06045C1832F 06045C1834F 06045C1850F 06045C1851F 06045C1852F 06045C1853F 06045C1854F 06045C1875F 06045C1900F[1] 06045C1920G 06045C1950G 06045C1975F 06045C2000F[1] 06045C2025F 06045C2050F 06045C2075F[1] 06045C2100F[1]	
Pinoleville Indian Reservation	060058	180010110	06045C1511F 06045C1512F	

Community	CID	HUC-8 Sub-Basin(s)	Located on FIRM Panel(s)	If Not Included, Location of Flood Hazard Data
Point Arena, City of	060185	18010108	06045C1740G 06045C1750G	
Ukiah, City of	060186	18010110	06045C1511F 06045C1512F 06045C1513F 06045C1514F 06045C1518F 06045C1677F 06045C1681F	
Willits, City of	060187	18010103	06045C1125F 06045C1111F 06045C1112F 06045C1113F 06045C1114F 06045C1300F	

[1]Panel Not Printed

1.4 Considerations for using this Flood Insurance Study Report

The NFIP encourages State and local governments to implement sound floodplain management programs. To assist in this endeavor, each FIS Report provides floodplain data, which may include a combination of the following: 10-, 4-, 2-, 1-, and 0.2-percent annual chance flood elevations (the 1% annual chance flood elevation is also referred to as the Base Flood Elevation (BFE)); delineations of the 1% annual chance and 0.2% annual chance floodplains; and 1% annual chance floodway. This information is presented on the FIRM and/or in many components of the FIS Report, including Flood Profiles, Floodway Data tables, Summary of Non-Coastal Stillwater Elevations tables, and Coastal Transect Parameters tables (not all components may be provided for a specific FIS).

This section presents important considerations for using the information contained in this FIS Report and the FIRM, including changes in format and content. Figures 1, 2, and 3 present information that applies to using the FIRM with the FIS Report.

- Part or all of this FIS Report may be revised and republished at any time. In addition, part of this FIS Report may be revised by a Letter of Map Revision (LOMR), which does not involve republication or redistribution of the FIS Report. Refer to Section 6.5 of this FIS Report for information about the process to revise the FIS Report and/or FIRM.

  It is, therefore, the responsibility of the user to consult with community officials by contacting the community repository to obtain the most current FIS Report components. Communities participating in the NFIP have established repositories of flood hazard data for floodplain management and flood insurance purposes. Community map repository addresses are provided in Table 31, "Map Repositories," within this FIS Report.

- New FIS Reports are frequently developed for multiple communities, such as entire counties. A countywide FIS Report incorporates previous FIS Reports for individual communities and the unincorporated area of the county (if not jurisdictional) into a single document and supersedes those documents for the purposes of the NFIP.

  The initial Countywide FIS Report for Mendocino County became effective on June 2, 2011. Refer to Table 28 for information about subsequent revisions to the FIRMs.

- FEMA does not impose floodplain management requirements or special insurance ratings based on Limit of Moderate Wave Action (LiMWA) delineations at this time. The LiMWA represents the approximate landward limit of the 1.5 foot breaking wave. If the LiMWA is shown on the FIRM, it is being provided by FEMA as information only. For communities that do adopt Zone VE building standards in the area defined by the LiMWA, additional Community Rating System (CRS) credits are available. Refer to Section 2.5.4 for additional information about the LiMWA.

  The CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Visit the FEMA Web site at http://www.fema.gov or contact your appropriate FEMA Regional Office for more information about this program.

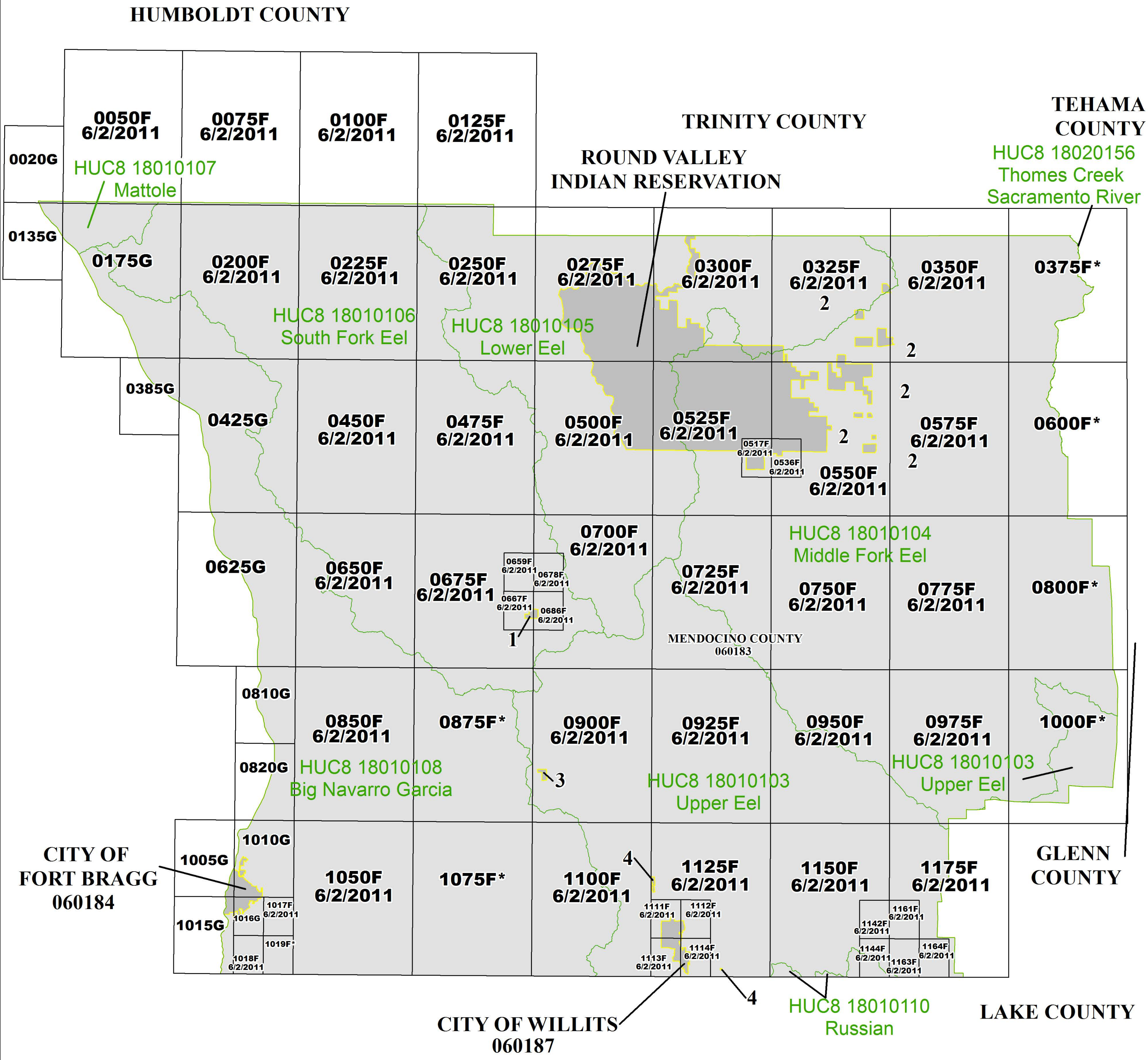
- Previous FIS Reports and FIRMs may have included levees that were accredited as reducing the risk associated with the 1% annual chance flood based on the information available and the mapping standards of the NFIP at that time. For FEMA to continue to accredit the identified levees, the levees must meet the criteria of the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10), titled “Mapping of Areas Protected by Levee Systems.”

  Since the status of levees is subject to change at any time, the user should contact the appropriate agency for the latest information regarding levees presented in Table 9 of this FIS Report. For levees owned or operated by the U.S. Army Corps of Engineers (USACE), information may be obtained from the USACE national levee database. For all other levees, the user is encouraged to contact the appropriate local community.

- FEMA has developed a *Guide to Flood Maps* (FEMA 258) and online tutorials to assist users in accessing the information contained on the FIRM. These include how to read panels and step-by-step instructions to obtain specific information. To obtain this guide and other assistance in using the FIRM, visit the FEMA Web site at http://www.fema.gov.

Figure 1: FIRM Panel Index

KEY NUMBER	COMMUNITY	CID
1	Laytonville Indian Reservation	
2	Sherwood Indian Reservation	



ATTENTION: The corporate limits shown on this FIRM Index are based on the best information available at the time of publication. As such, they may be more current than those shown on FIRM panels issued before

1 in = 6 miles

0 1.5 3 6 9 12 Miles

Map Projection:
Universal Transverse Mercator Zone 10 North;
North American Datum 1983

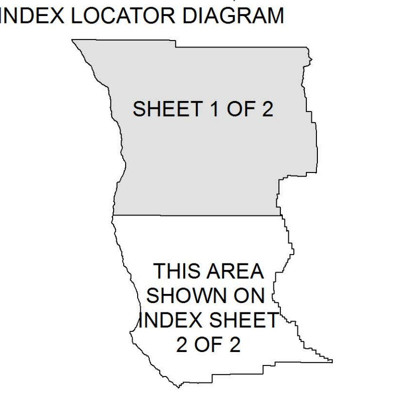
THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTP://MSC.FEMA.GOV

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION

*PANEL NOT PRINTED - NO SPECIAL FLOOD HAZARD AREAS

MENDOCINO COUNTY, CA
INDEX LOCATOR DIAGRAM



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP INDEX

MENDOCINO COUNTY, CALIFORNIA And Incorporated Areas
SHEET 1 OF 2

PANELS PRINTED:

0020, 0050, 0075, 0100, 0125, 0135, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0385, 0425, 0450, 0475, 0500, 0517, 0525, 0536, 0550, 0575, 0625, 0650, 0659, 0667, 0675, 0678, 0686, 0700, 0725, 0750, 0775, 0810, 0820, 0850, 0900, 0925, 0950, 0975, 1005, 1010, 1015, 1016, 1017, 1018, 1050, 1100, 1111, 1112, 1113, 1114, 1125, 1142, 1144, 1150, 1161, 1163, 1164, 1175

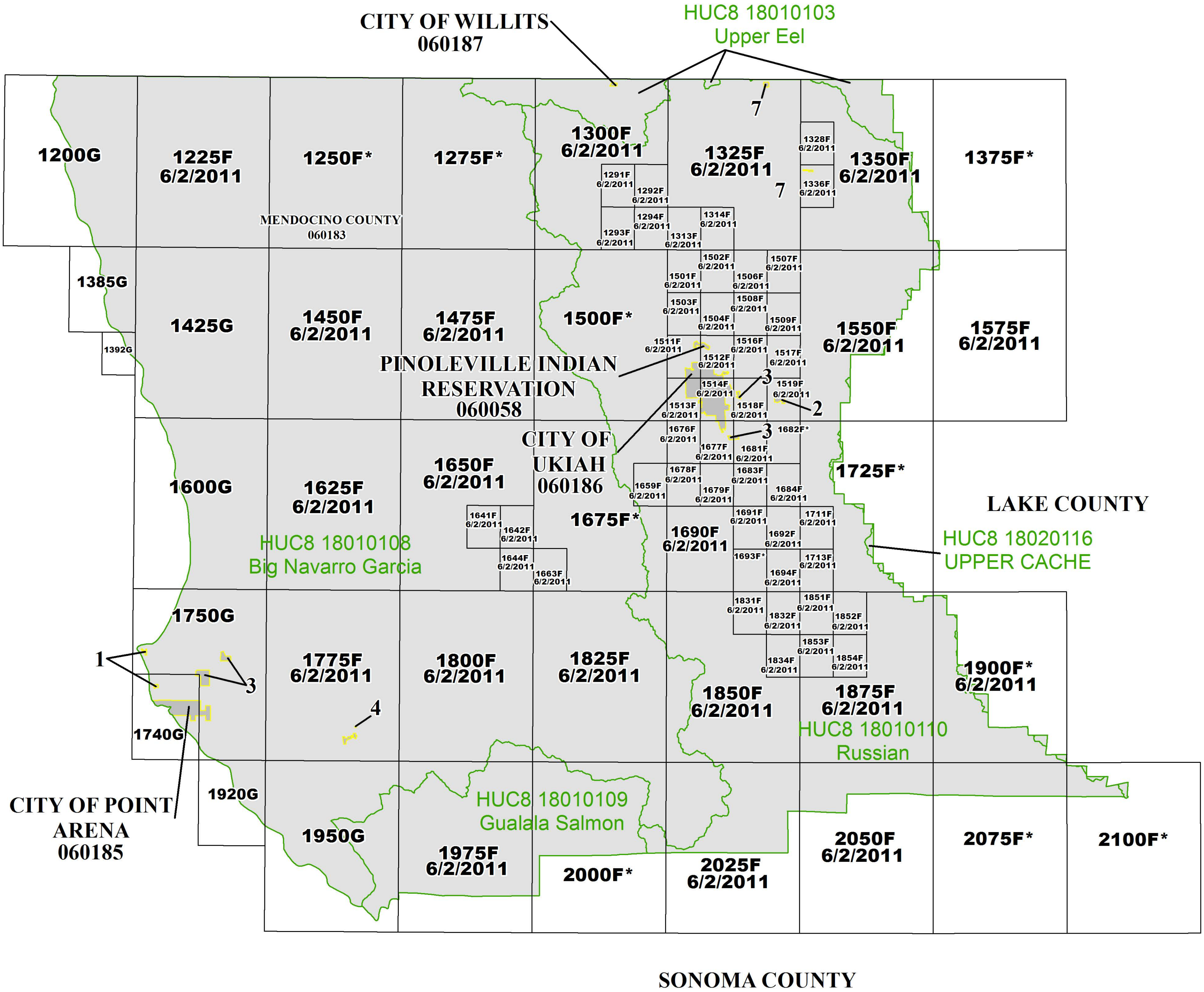
FEMA

MAP NUMBER
06045CIND1B

MAP REVISED

Figure 1: FIRM Panel Index

KEY NUMBER	COMMUNITY	CID
1	Coast Guard Reservation	
2	Guidiville Indian Reservation	
3	Manchester Indian Reservation	
4	Military Reservation	
5	Potter Valley Indian Reservation	



ATTENTION: The corporate limits shown on this FIRM Index are based on the best information available at the time of publication. As such, they may be more current than those shown on FIRM panels issued before

1 in = 6 miles

0 1.5 3 6 9 12 Miles

Map Projection:
Universal Tranverse Mercator Zone 10 North;
North American Datum 1983

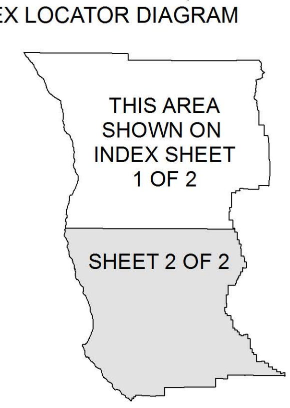
THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTP://MSC.FEMA.GOV

SEE FLOOD INSURANCE STUDY FOR ADDITIONAL INFORMATION

*PANEL NOT PRINTED - NO SPECIAL FLOOD HAZARD AREAS

MENDOCINO COUNTY, CA
INDEX LOCATOR DIAGRAM



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP INDEX

MENDOCINO COUNTY, CALIFORNIA And Incorporated Areas
SHEET 2 OF 2

PANELS PRINTED:

1200, 1225, 1291, 1292, 1293, 1294, 1300, 1313, 1314, 1325, 1328, 1336, 1350, 1385, 1392, 1425, 1450, 1475, 1501, 1502, 1503, 1504, 1506, 1507, 1508, 1509, 1511, 1512, 1513, 1514, 1516, 1517, 1518, 1519, 1550, 1600, 1625, 1641, 1642, 1644, 1650, 1659, 1663, 1676, 1677, 1678, 1679, 1681, 1683, 1684, 1690, 1691, 1692, 1694, 1711, 1713, 1740, 1750, 1775, 1800, 1825, 1831, 1832, 1834, 1850, 1851, 1852, 1853, 1854, 1875, 1920, 1950, 1975, 2025, 2050

FEMA

MAP NUMBER
06045CIND2B

MAP REVISED

Figure 2: FIRM Notes to Users

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products, or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates, refer to Table 28 in this FIS Report.

To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

PRELIMINARY FIS REPORT: FEMA maintains information about map features, such as street locations and names, in or near designated flood hazard areas. Requests to revise information in or near designated flood hazard areas may be provided to FEMA during the community review period, at the final Consultation Coordination Officer's meeting, or during the statutory 90-day appeal period. Approved requests for changes will be shown on the final printed FIRM.

The map is for use in administering the NFIP. It may not identify all areas subject to flooding, particularly from local drainage sources of small size. Consult the community map repository to find updated or additional flood hazard information.

BASE FLOOD ELEVATIONS: For more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables within this FIS Report. Use the flood elevation data within the FIS Report in conjunction with the FIRM for construction and/or floodplain management.

Coastal Base Flood Elevations shown on the map apply only landward of 0.0' North American Vertical Datum of 1983 (NAVD 88). Coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the FIS Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on the FIRM.

FLOODWAY INFORMATION: Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the FIS Report for this jurisdiction.

Figure 2. FIRM Notes to Users

FLOOD CONTROL STRUCTURE INFORMATION: Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 4.3 "Non-Levee Flood Protection Measures" of this FIS Report for information on flood control structures for this jurisdiction.

PROJECTION INFORMATION: The projection used in the preparation of the map was Universal Transverse Mercator (UTM) Zone 10 North**.** The horizontal datum was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of the FIRM.

ELEVATION DATUM: Flood elevations on the FIRM are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

Local vertical monuments may have been used to create the map. To obtain current monument information, please contact the appropriate local community listed in Table 31 of this FIS Report.

BASE MAP INFORMATION: Base map information shown on the FIRM was derived from multiple sources. Data was provided in digital format by Mendocino County GIS Department. This information was derived from Coastal California LiDAR and Digital Imagery dated 2011. USDA NAIP 2012 imagery is used in areas not covered by the Coastal California imagery. For information about base maps, refer to Section 6.2 “Base Map” in this FIS Report.

The map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables may reflect stream channel distances that differ from what is shown on the map.

Corporate limits shown on the map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after the map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Figure 2. FIRM Notes to Users

NOTES FOR FIRM INDEX

REVISIONS TO INDEX: As new studies are performed and FIRM panels are updated within Mendocino County, California, corresponding revisions to the FIRM Index will be incorporated within the FIS Report to reflect the effective dates of those panels. Please refer to Table 28 of this FIS Report to determine the most recent FIRM revision date for each community. The most recent FIRM panel effective date will correspond to the most recent index date.

SPECIAL NOTES FOR SPECIFIC FIRM PANELS

This Notes to Users section was created specifically for Mendocino County, California**,** effective [TBD]

FLOOD RISK REPORT: A Flood Risk Report (FRR) may be available for many of the flooding sources and communities referenced in this FIS report. The FRR is provided to increase public awareness of flood risk by helping communities identify the areas within their jurisdictions that have the greatest risks. Although non-regulatory, the information provided within the FRR can assist communities in assessing and evaluation mitigation opportunities to reduce these risks. It can also be used by communities developing or updating flood risk mitigation plans. These plans allow communities to identify and evaluate opportunities to reduce potential loss of life and property. However, the FRR is not intended to be the final authoritative source of all flood risk data for a project area; rather, it should be used with other data sources to paint a comprehensive picture of flood risk.

Figure 3: Map Legend for FIRM

SPECIAL FLOOD HAZARD AREAS: *The 1% annual chance flood, also known as the base flood or 100-year flood, has a 1% chance of happening or being exceeded each year. Special Flood Hazard Areas are subject to flooding by the 1% annual chance flood. The Base Flood Elevation is the water surface elevation of the 1% annual chance flood. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights. See note for specific types. If the floodway is too narrow to be shown, a note is shown.*

	Special Flood Hazard Areas subject to inundation by the 1% annual chance flood (Zones A, AE, AH, AO, AR, A99, V and VE)
Zone A	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. No base (1% annual chance) flood elevations (BFEs) or depths are shown within this zone.
Zone AE	The flood insurance rate zone that corresponds to the 1% annual chance floodplains. Base flood elevations derived from the hydraulic analyses are shown within this zone, either at cross section locations or as static whole-foot elevations that apply throughout the zone.
Zone AH	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot BFEs derived from the hydraulic analyses are shown at selected intervals within this zone.
Zone AO	The flood insurance rate zone that corresponds to the areas of 1% annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the hydraulic analyses are shown within this zone.
Zone AR	The flood insurance rate zone that corresponds to areas that were formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
Zone A99	The flood insurance rate zone that corresponds to areas of the 1% annual chance floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No base flood elevations or flood depths are shown within this zone.
Zone V	The flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations are not shown within this zone.
Zone VE	Zone VE is the flood insurance rate zone that corresponds to the 1% annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations derived from the coastal analyses are shown within this zone as static whole-foot elevations that apply throughout the zone.
	Regulatory Floodway determined in Zone AE.

Figure 3: Map Legend for FIRM

OTHER AREAS OF FLOOD HAZARD	
	Shaded Zone X: Areas of 0.2% annual chance flood hazards and areas of 1% annual chance flood hazards with average depths of less than 1 foot or with drainage areas less than 1 square mile.
	Future Conditions 1% Annual Chance Flood Hazard – Zone X: The flood insurance rate zone that corresponds to the 1% annual chance floodplains that are determined based on future-conditions hydrology. No base flood elevations or flood depths are shown within this zone.
	Area with Reduced Flood Risk due to Levee: Areas where an accredited levee, dike, or other flood control structure has reduced the flood risk from the 1% annual chance flood.
OTHER AREAS	
	Zone D (Areas of Undetermined Flood Hazard): The flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.
NO SCREEN	Unshaded Zone X: Areas of minimal flood hazard.
FLOOD HAZARD AND OTHER BOUNDARY LINES	
(ortho) (vector)	Flood Zone Boundary (white line on ortho-photography-based mapping; gray line on vector-based mapping)
	Limit of Study
	Jurisdiction Boundary
	Limit of Moderate Wave Action (LiMWA): Indicates the inland limit of the area affected by waves greater than 1.5 feet
GENERAL STRUCTURES	
Aqueduct *Channel* *Culvert* *Storm Sewer*	Channel, Culvert, Aqueduct, or Storm Sewer
Dam *Jetty* *Weir*	Dam, Jetty, Weir
	Levee, Dike or Floodwall
Bridge	Bridge

Figure 3: Map Legend for FIRM

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AND OTHERWISE PROTECTED AREAS (OPA): *CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas. See Notes to Users for important information.*

CBRS AREA 09/30/2009	Coastal Barrier Resources System Area: Labels are shown to clarify where this area shares a boundary with an incorporated area or overlaps with the floodway.
OTHERWISE PROTECTED AREA 09/30/2009	Otherwise Protected Area

REFERENCE MARKERS

22.0 ●	River mile Markers

CROSS SECTION & TRANSECT INFORMATION

B 20.2	Lettered Cross Section with Regulatory Water Surface Elevation (BFE)
5280 21.1	Numbered Cross Section with Regulatory Water Surface Elevation (BFE)
17.5	Unlettered Cross Section with Regulatory Water Surface Elevation (BFE)
8 - - - - - -	Coastal Transect
—— - —— -	Profile Baseline: Indicates the modeled flow path of a stream and is shown on FIRM panels for all valid studies with profiles or otherwise established base flood elevation.
——--——--	Coastal Transect Baseline: Used in the coastal flood hazard model to represent the 0.0-foot elevation contour and the starting point for the transect and the measuring point for the coastal mapping.
~~ 513 ~~~~	Base Flood Elevation Line (shown for flooding sources for which no cross sections or profile are available)
ZONE AE (EL 16)	Static Base Flood Elevation value (shown under zone label)
ZONE AO (DEPTH 2)	Zone designation with Depth
ZONE AO (DEPTH 2) (VEL 15 FPS)	Zone designation with Depth and Velocity

Figure 3: Map Legend for FIRM

BASE MAP FEATURES

Missouri Creek	River, Stream or Other Hydrographic Feature
234	Interstate Highway
234	U.S. Highway
234	State Highway
234	County Highway
MAPLE LANE	Street, Road, Avenue Name, or Private Drive if shown on Flood Profile
RAILROAD	Railroad
	Horizontal Reference Grid Line
	Horizontal Reference Grid Ticks
+	Secondary Grid Crosshairs
Land Grant	Name of Land Grant
7	Section Number
R. 43 W. T. 22 N.	Range, Township Number
$\mathbf{^{42}76^{000m}E}$	Horizontal Reference Grid Coordinates (UTM)
365000 FT	Horizontal Reference Grid Coordinates (State Plane)
80° 16’ 52.5”	Corner Coordinates (Latitude, Longitude)

SECTION 2.0 – FLOODPLAIN MANAGEMENT APPLICATIONS

2.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1% annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2% annual chance (500-year) flood is employed to indicate additional areas of flood hazard in the community.

Each flooding source included in the project scope has been studied and mapped using professional engineering and mapping methodologies that were agreed upon by FEMA and Mendocino County as appropriate to the risk level. Flood risk is evaluated based on factors such as known flood hazards and projected impact on the built environment. Engineering analyses were performed for each studied flooding source to calculate its 1% annual chance flood elevations; elevations corresponding to other floods (e.g. 10-, 4-, 2-, 0.2-percent annual chance, etc.) may have also been computed for certain flooding sources. Engineering models and methods are described in detail in Section 5.0 of this FIS Report. The modeled elevations at cross sections were used to delineate the floodplain boundaries on the FIRM; between cross sections, the boundaries were interpolated using elevation data from various sources. More information on specific mapping methods is provided in Section 6.0 of this FIS Report.

Depending on the accuracy of available topographic data (Table 23), study methodologies employed (Section 5.0), and flood risk, certain flooding sources may be mapped to show both the 1% and 0.2% annual chance floodplain boundaries, regulatory water surface elevations (BFEs), and/or a regulatory floodway. Similarly, other flooding sources may be mapped to show only the 1% annual chance floodplain boundary on the FIRM, without published water surface elevations. In cases where the 1% and 0.2% annual chance floodplain boundaries are close together, only the 1% annual chance floodplain boundary is shown on the FIRM. Figure 3, “Map Legend for FIRM”, describes the flood zones that are used on the FIRMs to account for the varying levels of flood risk that exist along flooding sources within the project area. Table 2 and Table 3 indicate the flood zone designations for each flooding source and each community within Mendocino County, California, respectively.

Table 2, “Flooding Sources Included in this FIS Report,” lists each flooding source, including its study limits, affected communities, mapped zone on the FIRM, and the completion date of its engineering analysis from which the flood elevations on the FIRM and in the FIS Report were derived. Descriptions and dates for the latest hydrologic and hydraulic analyses of the flooding sources are shown in Table 13. Floodplain boundaries for these flooding sources are shown on the FIRM (published separately) using the symbology described in Figure 3. On the map, the 1% annual chance floodplain corresponds to the SFHAs. The 0.2% annual chance floodplain shows areas that, although out of the regulatory floodplain, are still subject to flood hazards.

Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data. The procedures to remove these areas from the SFHA are described in Section 6.5 of this FIS Report.

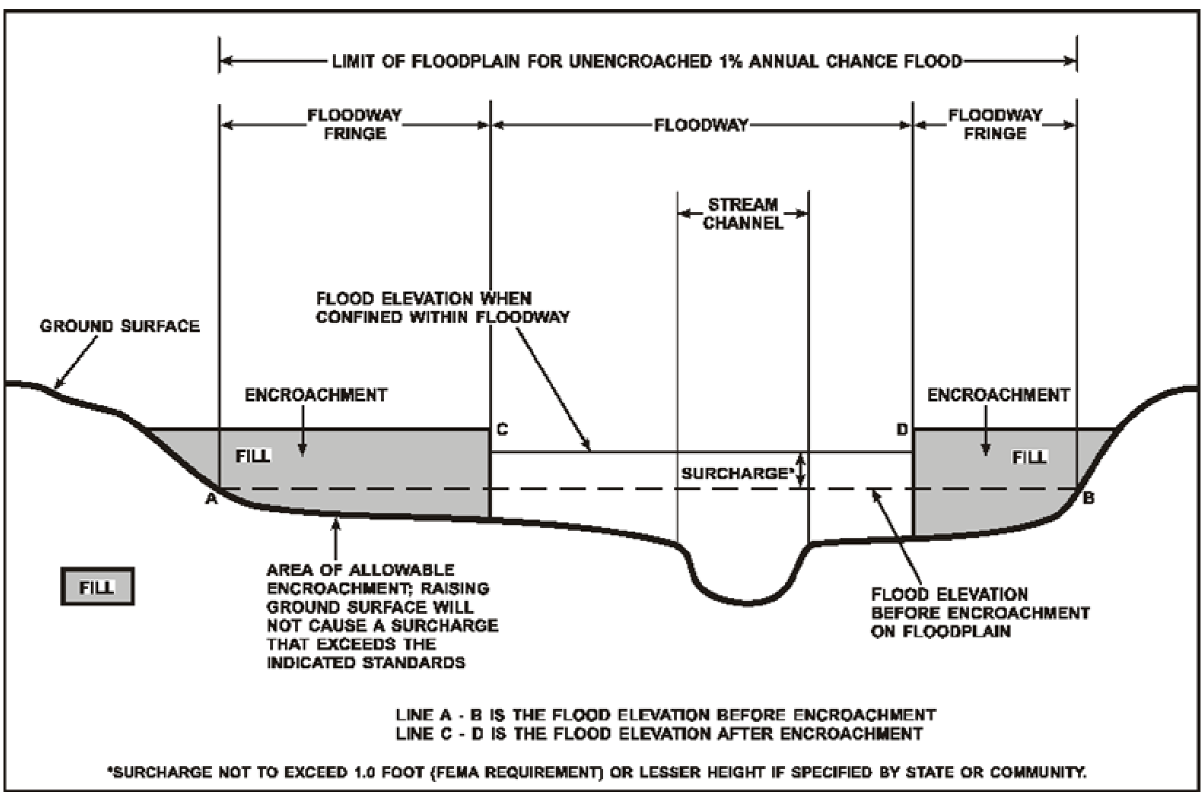
2.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard.

For purposes of the NFIP, a floodway is used as a tool to assist local communities in balancing floodplain development against increasing flood hazard. With this approach, the area of the 1% annual chance floodplain on a river is divided into a floodway and a floodway fringe based on hydraulic modeling. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment in order to carry the 1% annual chance flood. The floodway fringe is the area between the floodway and the 1% annual chance floodplain boundaries where encroachment is permitted. The floodway must be wide enough so that the floodway fringe could be completely obstructed without increasing the water surface elevation of the 1% annual chance flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 4.

To participate in the NFIP, Federal regulations require communities to limit increases caused by encroachment to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this project are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway projects.

Figure 4: Floodway Schematic



Floodway widths presented in this FIS Report and on the FIRM were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. For certain stream segments, floodways were adjusted so that the amount of floodwaters conveyed on each side of the floodplain would be reduced equally. The results of the floodway computations have been tabulated for selected cross sections and are shown in Table 24, “Floodway Data.”

All floodways that were developed for this Flood Risk Project are shown on the FIRM using the symbology described in Figure 3. In cases where the floodway and l% annual chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown on the FIRM. For information about the delineation of floodways on the FIRM, refer to Section 6.3.

Table 2: Flooding Sources Included in this FIS Report

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Ackerman Creek	Mendocino County, Unincorporated Areas	Confluence with Russian River	Approximately 123 feet upstream of Orr Springs Road	18010110	11	20.6	N		
Anderson Creek	Mendocino County, Unincorporated Areas	Approximately 0.34 miles downstream of confluence with Witherell Creek	Approximately 100 feet upstream of State Highway 253	18010106	10	35.4	N		
Broaddus Creek	Mendocino County, Unincorporated Areas	Confluence with Haehl/Baechtel Creek	Approximately 0.4 miles upstream of Main Street / US Highway 101	18010103	1.67	*	N		
Davis Creek	Mendocino County, Unincorporated Areas	At Hearst-Willts Road	Approximately 0.3 miles upstream of Private Drive	18010103	8	14.8	Y	A, AE	
Doolin Creek	Ukiah, City of; Mendocino County, Unincorporated Areas	Approximately 310 feet downstream of U.S. Highway 101 Northbound	Approximately 375 feet upstream of Helen Avenue / upstream Drive	18010110	4	7.2	Y	AE	
East Fork Russian River	Mendocino County, Unincorporated Areas	Approximately 0.34 miles downstream of Main Street	Approximately 0.3 miles upstream of confluence with Williams Creek	18010110	8	29.1	N	A	

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Eel River	Mendocino County, Unincorporated Areas	Approximately 1.85 miles downstream of Cape Horn Dam	Approximately 30 feet upstream of Eel River Road	18010103 18010105	30	353	Y	AE, A	
Feliz Creek	Mendocino County, Unincorporated Areas	Confluence with Russian River	Approximately 90 feet upstream of Old Hopland-Yorkville Road	18010110	11	433	N	A	
Forsythe Creek	Mendocino County, Unincorporated Areas	Confluence with Russian River	Approximately 64 feet upstream of Reeves Canyon Road	18010110	12.5	49.7	Y	A, AE	
Gibson Creek	City of Ukiah; Mendocino County, Unincorporated Areas	Approximately 0.35 miles downstream of U.S. Highway 101	Approximately 850 feet upstream of Standley Street	18010110	5	2.9	Y	AE	
Haehl/Baechtel Creek	Mendocino County, Unincorporated Areas	Approximately 360 feet upstream of confluence with Broaddus Creek	Approximately 0.4 miles upstream of confluence with Baechtel Creek Tributary A	18010103	2	*	Y	A, AE	
Hensley Creek	Mendocino County, Unincorporated Areas	Confluence with Russian River	Approximately 1 mile upstream of Unnamed Road	18010110	7	7.6	Y	A, AE	
Mill Creek (at Redwood Valley)	Mendocino County, Unincorporated Areas	Confluence with Forsythe Creek	Approximately 24 feet upstream of Reeves Canyon Road	18010110	8.5	11.4	Y	AE	

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Mill Creek (at Willits)	Mendocino County, Unincorporated Areas; Willits, City of	Approximately 700 feet downstream of Little Lake Industrial Downstream Lumberyard Bridge	Approximately 0.45 miles upstream of Mill Creek Drive	18010103	1.2	*	Y	AE	
Mill Creek (near Talmage)	Mendocino County, Unincorporated Areas	Approximately 800 feet downstream of confluence with McClure Creek	Approximately 0.4 miles upstream of confluence of North Fork Mill Creek	18010110	6	18.0	Y	A, AE	
North Fork Mill Creek	Mendocino County, Unincorporated Areas	Confluence with Mill Creek (Near Talmage)	Approximately 798 feet upstream of Guidiville Reservation Road	18010110	4	5.3	Y	A, AE	
Noyo River	Mendocino County, Unincorporated Areas	Approximately 457 feet downstream of Highway 1	Approximately 1.4 miles upstream of Highway 1	18010108	*	*	N	A, AE	
Orrs Creek	Mendocino County, Unincorporated Areas; Ukiah, City of	Approximately 86 feet downstream of US Highway 101	Approximately 0.3 miles upstream of Low Gap Park Bridge	18010110	8	10.2	Y	AE	
Robinson Creek	Mendocino County, Unincorporated Areas	Approximately 856 feet downstream of US Highway 101 Northbound	Approximately 163 feet upstream of Robinson Creek Road	18010110	8	26.7	Y	AE	
Russian River	Mendocino County, Unincorporated Areas	Approximately 100 feet downstream of US Highway 101	Approximately 0.2 miles upstream of School Way	18010110	*	437	Y	A, AE	

Flooding Source	Community	Downstream Limit	Upstream Limit	HUC-8 Sub-Basin(s)	Length (mi) (streams or coastlines)	Area (mi^2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Sulphur Creek	Mendocino County, Unincorporated Areas	At Vichy Springs Road	Approximately 307 feet upstream of Tehuacan Road	18010110	*	*	Y	A, AE	
Tenmile Creek	Mendocino County, Unincorporated Areas	Approximately 0.2 miles downstream of Branscomb Road	Approximately 422 feet upstream of confluence of Cahto Creek	18010106	7	20.9	Y	A, AE	
Town Creek	Mendocino County, Unincorporated Areas; Round Valley Indian Reservation	Confluence with Grist Creek	Approximately 0.6 miles upstream of Covelo Road/State Highway 162	18010104	7	11.3	Y	A, AE	
York Creek	Mendocino County, Unincorporated Areas	Confluence with Russian River	Approximately 1.7 miles upstream of Old Bridge	18010110	8	12.0	Y	A, AE	

All floodways that were developed for this Flood Risk Project are shown on the FIRM using the symbology described in Figure 3. In cases where the floodway and l% annual chance floodplain boundaries are either close together or collinear, only the floodway boundary has been shown on the FIRM. For information about the delineation of floodways on the FIRM, refer to Section 6.3.

2.3 Base Flood Elevations

The hydraulic characteristics of flooding sources were analyzed to provide estimates of the elevations of floods of the selected recurrence intervals. The Base Flood Elevation (BFE) is the elevation of the 1% annual chance flood. These BFEs are most commonly rounded to the whole foot, as shown on the FIRM, but in certain circumstances or locations they may be rounded to 0.1 foot. Cross section lines shown on the FIRM may also be labeled with the BFE rounded to 0.1 foot. Whole-foot BFEs derived from engineering analyses that apply to coastal areas, areas of ponding, or other static areas with little elevation change may also be shown at selected intervals on the FIRM.

Cross sections with BFEs shown on the FIRM correspond to the cross sections shown in the Floodway Data table and Flood Profiles in this FIS Report. BFEs are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM.

2.4 Non-Encroachment Zones

Some States and communities use non-encroachment zones to manage floodplain development. For flooding sources with medium flood risk, field surveys are often not collected and surveyed bridge and culvert geometry is not developed. Standard hydrologic and hydraulic analyses are still performed to determine BFEs in these areas. However, floodways are not typically determined, since specific channel profiles are not developed. To assist communities with managing floodplain development in these areas, a “non-encroachment zone” may be provided. While not a FEMA designated floodway, the non-encroachment zone represents that area around the stream that should be reserved to convey the 1% annual chance flood event. As with a floodway, all surcharges must fall within the acceptable range in the non-encroachment zone.

General setbacks can be used in areas of lower risk (e.g. unnumbered Zone A), but these are not considered sufficient where unnumbered Zone A is replaced by Zone AE. The NFIP requires communities to ensure that any development in a non-encroachment area causes no increase in BFEs. Communities must generally prohibit development within the area defined by the non-encroachment width to meet the NFIP requirement. Regulations for California require communities in Mendocino County to limit increases caused by encroachment to 0.5 foot and several communities have adopted additional restrictions for non-encroachment areas. Regulations for California require communities in Mendocino County to limit increases caused by encroachment to 0.5 foot and several communities have adopted additional restrictions for non-encroachment areas.

Non-encroachment determinations may be delineated where it is not possible to delineate floodways because specific channel profiles with bridge and culvert geometry were not developed. Any non-encroachment determinations for this Flood Risk Project have been tabulated for selected cross sections and are shown in Table 25, “Flood Hazard and Non-Encroachment

Data for Selected Streams." Areas for which non-encroachment zones are provided show BFEs and the 1% annual chance floodplain boundaries mapped as zone AE on the FIRM but no floodways.

2.5 Coastal Flood Hazard Areas

For most areas along rivers, streams, and small lakes, BFEs and floodplain boundaries are based on the amount of water expected to enter the area during a 1% annual chance flood and the geometry of the floodplain. Floods in these areas are typically caused by storm events. However, for areas on or near ocean coasts, large rivers, or large bodies of water, BFE and floodplain boundaries may need to be based on additional components, including storm surges and waves. Communities on or near ocean coasts face flood hazards caused by offshore seismic events as well as storm events.

Coastal flooding sources that are included in this Flood Risk Project are shown in Table 2.

2.5.1 Water Elevations and the Effects of Waves

Specific terminology is used in coastal analyses to indicate which components have been included in evaluating flood hazards.

The stillwater elevation (SWEL or still water level) is the surface of the water resulting from astronomical tides, storm surge, and freshwater inputs, but excluding wave setup contribution or the effects of waves.

- *Astronomical tides* are periodic rises and falls in large bodies of water caused by the rotation of the earth and by the gravitational forces exerted by the earth, moon and sun.
- *Storm surge* is the additional water depth that occurs during large storm events. These events can bring air pressure changes and strong winds that force water up against the shore.
- *Freshwater inputs* include rainfall that falls directly on the body of water, runoff from surfaces and overland flow, and inputs from rivers.

The 1% annual chance stillwater elevation is the stillwater elevation that has been calculated for a storm surge from a 1% annual chance storm. The 1% annual chance storm surge can be determined from analyses of tidal gage records, statistical study of regional historical storms, or other modeling approaches. Stillwater elevations for storms of other frequencies can be developed using similar approaches.

The total stillwater elevation (also referred to as the mean water level) is the stillwater elevation plus wave setup contribution but excluding the effects of waves.

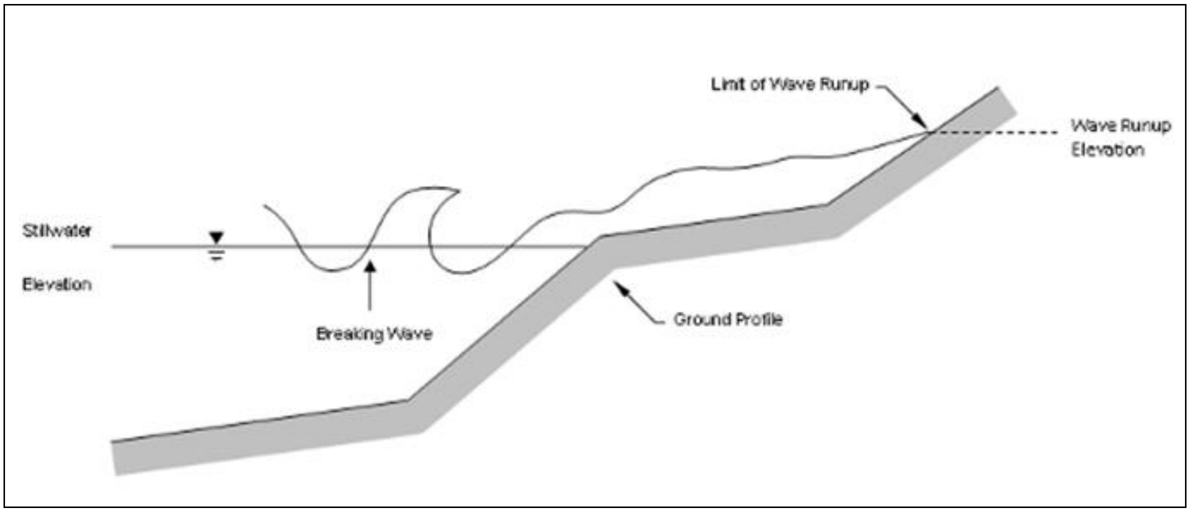
- *Wave setup* is the increase in stillwater elevation at the shoreline caused by the reduction of waves in shallow water. It occurs as breaking wave momentum is transferred to the water column.

Like the stillwater elevation, the total stillwater elevation is based on a storm of a particular frequency, such as the 1% annual chance storm. Wave setup is typically estimated using standard engineering practices or calculated using models, since tidal gages are often sited in areas sheltered from wave action and do not capture this information.

Coastal analyses may examine the effects of overland waves by analyzing storm-induced erosion, overland wave propagation, wave runup, and/or wave overtopping.

- *Storm-induced erosion* is the modification of existing topography by erosion caused by a specific storm event, as opposed to general erosion that occurs at a more constant rate.
- *Overland wave propagation* describes the combined effects of variation in ground elevation, vegetation, and physical features on wave characteristics as waves move onshore.
- *Wave runup* is the uprush of water from wave action on a shore barrier. It is a function of the roughness and geometry of the shoreline at the point where the stillwater elevation intersects the land.
- *Wave overtopping* refers to wave runup that occurs when waves pass over the crest of a barrier.

Figure 5: Wave Runup Transect Schematic



2.5.2 Floodplain Boundaries and BFEs for Coastal Areas

For coastal communities along the Atlantic and Pacific Oceans, the Gulf of Mexico, the Great Lakes, and the Caribbean Sea, flood hazards must take into account how storm surges, waves, and extreme tides interact with factors such as topography and vegetation. Storm surge and waves must also be considered in assessing flood risk for certain communities on rivers or large inland bodies of water.

Beyond areas that are affected by waves and tides, coastal communities can also have riverine floodplains with designated floodways, as described in previous sections.

Floodplain Boundaries

In many coastal areas, storm surge is the principle component of flooding. The extent of the 1% annual chance floodplain in these areas is derived from the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1% annual chance storm. The methods that were used for calculation of total stillwater elevations for coastal areas are described in Section 5.3 of this FIS Report. Location of total stillwater elevations for coastal areas are shown in Figure 8, “1% Annual Chance Total Stillwater Levels for Coastal Areas.”

In some areas, the 1% annual chance floodplain is determined based on the limit of wave runup or wave overtopping for the 1% annual chance storm surge. The methods that were used for calculation of wave hazards are described in Section 5.3 of this FIS Report.

Table 26 presents the types of coastal analyses that were used in mapping the 1% annual chance floodplain in coastal areas.

Coastal BFEs

Coastal BFEs are calculated as the total stillwater elevation (stillwater elevation including storm surge plus wave setup) for the 1% annual chance storm plus the additional flood hazard from overland wave effects (storm-induced erosion, overland wave propagation, wave runup and wave overtopping).

Where they apply, coastal BFEs are calculated along transects extending from offshore to the limit of coastal flooding onshore. Results of these analyses are accurate until local topography, vegetation, or development type and density within the community undergoes major changes.

Parameters that were included in calculating coastal BFEs for each transect included in this FIS Report are presented in Table 17, “Coastal Transect Parameters.” The locations of transects are shown in Figure 9, “Transect Location Map.” More detailed information about the methods used in coastal analyses and the results of intermediate steps in the coastal analyses are presented in Section 5.3 of this FIS Report. Additional information on specific mapping methods is provided in Section 6.4 of this FIS Report.

2.5.3 Coastal High Hazard Areas

Certain areas along the open coast and other areas may have higher risk of experiencing structural damage caused by wave action and/or high-velocity water during the 1% annual chance flood. These areas will be identified on the FIRM as Coastal High Hazard Areas.

- *Coastal High Hazard Area (CHHA)* is a SFHA extending from offshore to the inland limit of the primary frontal dune (PFD) or any other area subject to damages caused by wave action and/or high-velocity water during the 1% annual chance flood.
- *Primary Frontal Dune (PFD)* is a continuous or nearly continuous mound or ridge of sand with relatively steep slopes immediately landward and adjacent to the beach. The PFD is subject to erosion and overtopping from high tides and waves during major coastal storms.

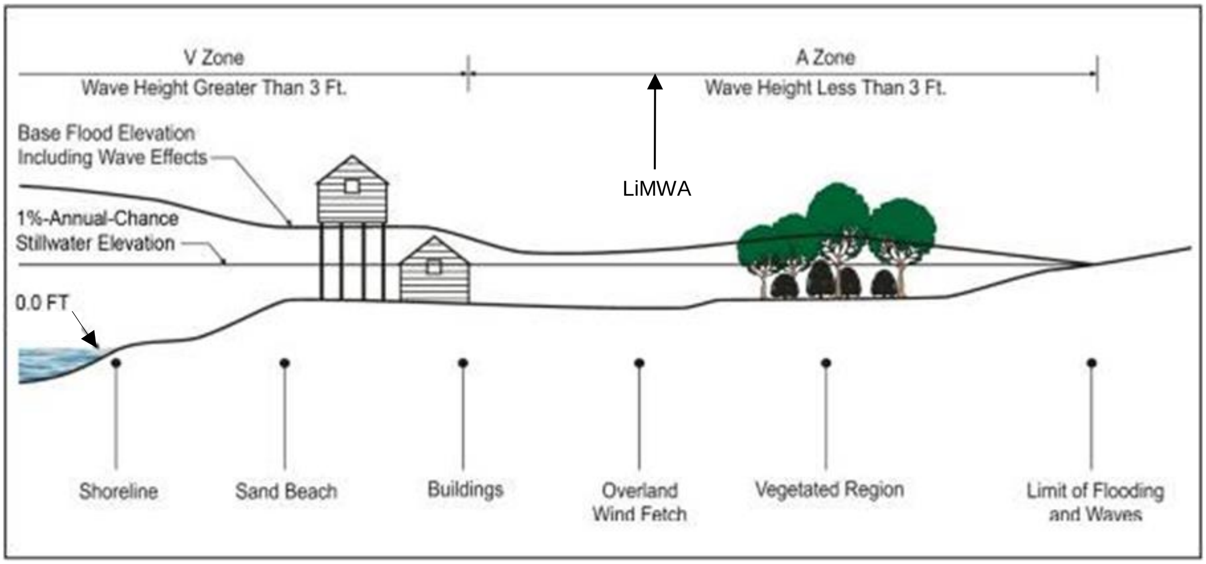
CHHAs are designated as “V” zones (for “velocity wave zones”) and are subject to more stringent regulatory requirements and a different flood insurance rate structure. The areas of greatest risk are shown as VE on the FIRM. Zone VE is further subdivided into elevation zones and shown with BFEs on the FIRM.

The landward limit of the PFD occurs at a point where there is a distinct change from a relatively steep slope to a relatively mild slope; this point represents the landward extension of Zone VE. Areas of lower risk in the CHHA are designated with Zone V on the FIRM. More detailed information about the identification and designation of Zone VE is presented in Section 6.4 of this FIS Report.

Areas that are not within the CHHA but are SFHAs may still be impacted by coastal flooding and damaging waves; these areas are shown as “A” zones on the FIRM.

Figure 6, "Coastal Transect Schematic," illustrates the relationship between the base flood elevation, the 1% annual chance stillwater elevation, and the ground profile as well as the location of the Zone VE and Zone AE areas in an area without a PFD subject to overland wave propagation. This figure also illustrates energy dissipation and regeneration of a wave as it moves inland.

Figure 6: Coastal Transect Schematic



Methods used in coastal analyses in this Flood Risk Project are presented in Section 5.3 and mapping methods are provided in Section 6.4 of this FIS Report.

Coastal floodplains are shown on the FIRM using the symbology described in Figure 3, "Map Legend for FIRM." In many cases, the BFE on the FIRM is higher than the stillwater elevations shown in Table 17, due to the presence of wave effects. The higher elevation should be used for construction and/or floodplain management purposes.

2.5.4 Limit of Moderate Wave Action

This section is not applicable to this Flood Risk Project.

SECTION 3.0 – INSURANCE APPLICATIONS

3.1 National Flood Insurance Program Insurance Zones

For flood insurance applications, the FIRM designates flood insurance rate zones as described in Figure 3, "Map Legend for FIRM." Flood insurance zone designations are assigned to flooding sources based on the results of the hydraulic or coastal analyses. Insurance agents use the zones shown on the FIRM and depths and base flood elevations in this FIS Report in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

The 1% annual chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (e.g. Zones A, AE, V, VE, etc.), and the 0.2% annual chance floodplain boundary corresponds to the boundary of areas of additional flood hazards.

Table 3 lists the flood insurance zones in the unincorporated and incorporated areas of Mendocino County.

Table 3: Flood Zone Designations by Community

Community	Flood Zone(s)
Mendocino County, Unincorporated Areas	A, AE, D, VE, X
City of Fort Bragg	A, VE, X
Pinoleville Indian Reservation	AE, X
City of Point Arena	A, VE, X
City of Ukiah	A, AE, X
City of Willits	AE, X

3.2 Coastal Barrier Resources System

The Coastal Barrier Resources Act (CBRA) of 1982 was established by Congress to create areas along the Atlantic and Gulf coasts and the Great Lakes, where restrictions for Federal financial assistance including flood insurance are prohibited. In 1990, Congress passed the Coastal Barrier Improvement Act (CBIA), which increased the extent of areas established by the CBRA and added "Otherwise Protected Areas" (OPA) to the system. These areas are collectively referred to as the John. H Chafee Coastal Barrier Resources System (CBRS). The CBRS boundaries that have been identified in the project area are in Table 4, "Coastal Barrier Resource System Information."

Table 4: Coastal Barrier Resources System Information

[Not Applicable to this Flood Risk Project]

SECTION 4.0 – AREA STUDIED

4.1 Basin Description

Table 5 contains a description of the characteristics of the HUC-8 sub-basins within which each community falls. The table includes the main flooding sources within each basin, a brief description of the basin, and its drainage area.

Table 5: Basin Characteristics

HUC-8 Sub-Basin Name	HUC-8 Sub-Basin Number	Primary Flooding Source	Description of Affected Area	Drainage Area (acres)
Big Navarro Garcia	18010108	Big River	*	1,025,614

HUC-8 Sub-Basin Name	HUC-8 Sub-Basin Number	Primary Flooding Source	Description of Affected Area	Drainage Area (acres)
Gualala-Salmon	18010109	Gualala River	*	354,855
Lower Eel	18010105	Eel River	*	979,249
Mattole	18010107	Mattole River	*	478,324
Middle Fork Eel	18010104	Eel River	*	482,179
Russian	18010110	Russian River	*	950,360
South Fork Eel	18010106	South Fork Eel River	*	441,104
Upper Eel	18010103	Eel River	*	453,806

* Data not available

4.2 Principal Flood Problems

Table 6 contains a description of the principal flood problems that have been noted for Mendocino County by flooding source.

Table 6: Principal Flood Problems

Flooding Source	Description of Flood Problems
All sources	The major floods in unincorporated Mendocino County have resulted from extended periods of winter rainfall produced by storms from the Pacific Ocean. Flooding on several of the streams studied in detail have been extensively documented by gage records, high-water marks, damage surveys, and personal accounts. Areas of Mendocino County are also subject to flooding from storm tides.
All Sources within City of Willits	The major floods in Willits have resulted from extended periods of winter rainfall produced by storms from the Pacific Ocean. The eastern section of Willits is subject to flooding from the streams flowing into Little Lake Valley from the west (Mill (at Willits) and Broaddus Creeks) and south (Haehl/Baechtel Creek). The extent of flooding has been documented by high-water-mark elevations taken by the USACE. The most recent flooding occurred in January 1974; however, no gage data are available to estimate the recurrence interval. The extent of flooding for major floods other than December 1964 (December 1955, January 1974, and others) has not been documented by published high-water marks; however, the December 1964 event was the largest flood of record on Eel River, to the east of Willits. Stream blockage by debris has been cited as a problem by city officials during past floods. The area between U.S. Highway 101 and the Southern Pacific Railroad tracks north of Mill Creek 9at Willits) to the northern corporate limits is subject to shallow flooding resulting from ponding and backwater flooding. Water from

Flooding Source	Description of Flood Problems
	the streams flowing into Little Lake Valley floods the flat valley floor, including this portion of land within the corporate limits.
All Sources within City of Ukiah	The major floods in Ukiah have resulted from extended periods of winter rainfall produced by storms from the Pacific Ocean. The eastern portion of Ukiah is subject to flooding from the Russian River. Flooding in the Russian River valley has been extensively documented by gage records, high-water marks, damage surveys, and personal accounts. Past flooding problems on Orrs, Gibson, and Doolin Creeks are not documented by streamflow gage records. However, the USACE did collect and tabulate high-water-mark elevations from the 1964 flood on Orrs, Gibson, and Doolin Creeks (USACE, n.d.(c); USACE, December 1965).
Eel River	Several publications have described the floods of December 1955 and December 1964 in the Russian and Eel River watersheds (State of California, January 1965; USACE, June 1956; USACE, January 1965; Winsler Kelly Consulting Engineers, May 1970; and USGS, 1969). Damage estimates for the 1955 flood in the Russian River valley amounted to over $5 million for the combined area of Mendocino and Sonoma Counties (USACE, June 1956). Over $64 million in dmagae and 19 deaths were the result of the 1964 flood on the Eel River (Winsler & Kelly consulting Engineers, May 1970; USGS, 1969). Most of the damage and destruction resulting from the 1955 and 1964 floods in the Russian and Eel River watersheds occurred in the areas downstream and outside of Mendocino County.
East Fork Russian River	The flood of 1955 was larger than the 1964 flood in the Ukiah area. The decrease in size of the peak flow in 1964 was a result of the storage of excessive flows from the East Fork Russian River into Lake Mendocino created by Coyote Dam northeast of Ukiah in 1958 (State of California, January 1965).
Noyo Harbor	Flooding in Noyo Harbor can be caused by high river flows and high tides with storm surge. The most destructive flooding which occurred in April 1964 was caused by tsunami and associated tidal surges resulting from the Alaskan earthquake. Heavy rains in January of 1966 caused damage to boats in the harbor, primarily as a result of high velocity river flows carrying large logs and other debris. However, there are no records of flood damage during the maximum recorded river discharge of 26,600 cfs in 1974, almost 50 percent greater than the maximum river flow of 19,200 cfs in 1966.
Pacific Ocean	Flooding along the Pacific coast at Point Arena is typically associated with the simultaneous occurrence of very high tides, large waves, and storm swells during the winter. As a result, ocean-front development has not been compatible with the natural instability of the shoreline and the intense winter weather conditions. Tsunami (sea waves generated from oceanic earthquakes, submarine landslides, and volcanic eruptions) create some of the most destructive natural water waves. As tsunami waves approach shallow coastal waters, wave refraction, shoaling, and bay resonance amplify the wave heights. Storm centers from the southwest produce the type of storm pattern most commonly responsible for the majority of the serious coastal flooding. The strong winds and high tides that create storm surges are also accompanied by heavy rains. In some instances, high tides back up riverflows, which

Flooding Source	Description of Flood Problems
	causes flooding at the river mouth. In the past, developed portions of the northern California coast have been damaged as a result of severe winter storms. The most severe storms to hit the California coast occurred in 1978 and 1983, when high water levels were accompanied by very large storm waves. In January 1978, a series of storms emanated from a more southerly direction than normally occurs; consequently, some of the better protected beaches in the area were also damaged. The winter of 1983 brought an extremely unusual series of high tides, storm surges, and storm waves that caused damage along the northern California coast (Ott Water Engineering, Inc., August 1984).
Russian River	The eastern portion of Ukiah is subject to flooding from the Russian River. Flooding in the Russian River valley has been extensively documented by gage records, high-water marks, damage surveys, and personal accounts. Regulation of the Russian River streamflow since 1958 with the construction of Coyote Dam (Lake Mendocino) on the East Fork Russian River has reduced the peak discharge. The largest flood recorded since 1958 occurred on December 22, 1964, with a measured peak discharge of 41,500 cfs and an estimated recurrence interval of 32 years. The only other large flood to occur since 1958 was on January 16, 1974, with a peak discharge of 39,700 cfs and an estimated recurrence interval of 25 years. Several publications have described the floods of December 1955 and December 1964 in the Russian and Eel River watersheds (State of California, January 1965; USACE, June 1956; USACE, January 1965; Winsler Kelly Consulting Engineers, May 1970; and USGS, 1969). Damage estimates for the 1955 flood in the Russian River valley amounted to over $5 million for the combined area of Mendocino and Sonoma Counties (USACE, June 1956). Over $64 million in damage and 19 deaths were the result of the 1964 flood on the Eel River (Winsler & Kelly consulting Engineers, May 1970; USGS, 1969). Most of the damage and destruction resulting from the 1955 and 1964 floods in the Russian and Eel River watersheds occurred in the areas downstream and outside of Mendocino County.

Table 7 contains information about historic flood elevations in the communities within Mendocino County.

Table 7: Historic Flooding Elevations

Flooding Source	Location	Historic Peak (Feet NAVD88)	Event Date	Approximate Recurrence Interval (years)	Source of Data
Eel River	Van Arsdale Reservoir	*	1937	14	USGS gage (No. 11471500)
Eel River	Van Arsdale Reservoir	*	1955	18	USGS gage (No. 11471500)

Flooding Source	Location	Historic Peak (Feet NAVD88)	Event Date	Approximate Recurrence Interval (years)	Source of Data
Eel River	Van Arsdale Reservoir	*	1964	44	USGS gage (No. 11471500)
Feliz Creek	*	*	1964	*	USGS gage (No. 11462700)
Russian River	Near Hopeland	*	1955	46	USGS gage (No. 11462500)
Russian River	Near the City of Ukiah		1955	36	USGS gage (No. 11461000)
Russian River	*	*	1964	32	*
Russian River	*	*	1974	25	*

*Data not available

4.3 Non-Levee Flood Protection Measures

Table 8 contains information about non-levee flood protection measures within Mendocino County such as dams, jetties, and or dikes. Levees are addressed in Section 4.4 of this FIS Report.

Table 8: Non-Levee Flood Protection Measures

Flooding Source	Structure Name	Type of Measure	Location	Description of Measure
Albion River	Albion	Revetment	From State Route 1 to approximately 0.5 miles upstream of State Route 1	Coastal Armoring Structure
Arena Cove	Arena Cover	Revetment	Near Point Arena Creek confluence with Arena Cove	Coastal Armoring Structure
Caspar Creek	Caspar	Revetment	Along Caspar Little Lake Road near confluence with Pacific Ocean	Coastal Armoring Structure
East Fork Russian River	Coyote Dam	Dam	Below Potter Valley	Constructed by USACE in 1958
Eel River	Cape Horn Dam	Dam	Van Arsdale Reservoir	Operated by Pacific Gas and Electric

Flooding Source	Structure Name	Type of Measure	Location	Description of Measure
Gibson Creek	N/A	Concrete walls	Between Orchard Street and Warren Drive	Streambanks have been reinforced with concrete walls to contain minor floods
Juan Creek	Juan Creek	Revetment	Downstream of State Route 1	Coastal Armoring Structure
Little River	Van Damme Beach	Seawall	Downstream of State Route 1	Coastal Armoring Structure
Noyo River	Noyo River	Jetty	Downstream of State Route 1 in Noyo Bay	Beach stabilization structure
Noyo River	Noyo River	Jetty	Downstream of State Route 1 in Noyo Bay	Beach stabilization structure

4.4 Levees

For purposes of the NFIP, FEMA only recognizes levee systems that meet, and continue to meet, minimum design, operation, and maintenance standards that are consistent with comprehensive floodplain management criteria. The Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10) describes the information needed for FEMA to determine if a levee system reduces the risk from the 1% annual chance flood. This information must be supplied to FEMA by the community or other party when a flood risk study or restudy is conducted, when FIRMs are revised, or upon FEMA request. FEMA reviews the information for the purpose of establishing the appropriate FIRM flood zone.

Levee systems that are determined to reduce the risk from the 1% annual chance flood are accredited by FEMA. FEMA can also grant provisional accreditation to a levee system that was previously accredited on an effective FIRM and for which FEMA is awaiting data and/or documentation to demonstrate compliance with Section 65.10. These levee systems are referred to as Provisionally Accredited Levees, or PALs. Provisional accreditation provides communities and levee owners with a specified timeframe to obtain the necessary data to confirm the levee’s certification status. Accredited levee systems and PALs are shown on the FIRM using the symbology shown in Figure 3 and in Table 9. If the required information for a PAL is not submitted within the required timeframe, or if information indicates that a levee system not longer meets Section 65.10, FEMA will de-accredit the levee system and issue an effective FIRM showing the levee-impacted area as a SFHA.

FEMA coordinates its programs with USACE, who may inspect, maintain, and repair levee systems. The USACE has authority under Public Law 84-99 to supplement local efforts to repair flood control projects that are damaged by floods. Like FEMA, the USACE provides a program to allow public sponsors or operators to address levee system maintenance deficiencies. Failure to do so within the required timeframe results in the levee system being placed in an inactive status in the USACE Rehabilitation and Inspection Program. Levee systems in an inactive status are ineligible for rehabilitation assistance under Public Law 84-99.

FEMA coordinated with the USACE, the local communities, and other organizations to compile a list of levees that exist within Mendocino County. Table 9, "Levees," lists all accredited levees, PALs, and de-accredited levees shown on the FIRM for this FIS Report. Other categories of levees may also be included in the table. The Levee ID shown in this table may not match numbers based on other identification systems that were listed in previous FIS Reports. Levees identified as PALs in the table are labeled on the FIRM to indicate their provisional status.

Please note that the information presented in Table 9 is subject to change at any time. For that reason, the latest information regarding any USACE structure presented in the table should be obtained by contacting USACE and accessing the USACE national levee database. For levees owned and/or operated by someone other than the USACE, contact the local community shown in Table 31.

Table 9: Levees

Community	Flooding Source	Levee Location	Levee Owner	USACE Levee	Levee ID	Covered Under PL84-99 Program?	FIRM Panel(s)	Levee Status
Mendocino County, Unincorporated Areas	Anderson Creek	Right Bank	*	*	06045C30	*	06045C1663F	*
Mendocino County, Unincorporated Areas	Anderson Creek	*	*	*	06045C29	*	06045C1663F	*
Mendocino County, Unincorporated Areas	Russian River	Left Bank	*	*	06045C25	*	06045C1502F	*
Round Valley Indian Reservation	Short Creek	Left Bank	*	*	06045C32	*	06045C0550F	*

*Data not available

SECTION 5.0 – ENGINEERING METHODS

For the flooding sources in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded at least once on the average during any 10-, 25-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 25-, 50-, 100-, and 500-year floods, have a 10-, 4-, 2-, 1-, and 0.2% annual chance, respectively, of being equaled or exceeded during any year.

Although the recurrence interval represents the long-term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedance) during the term of a 30-year mortgage is approximately 26 percent (about 3 in 10); for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

The engineering analyses described here incorporate the results of previously issued Letters of Map Change (LOMCs) listed in Table 27, “Incorporated Letters of Map Change”, which include Letters of Map Revision (LOMRs). For more information about LOMRs, refer to Section 6.5, “FIRM Revisions.”

5.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak elevation-frequency relationships for floods of the selected recurrence intervals for each flooding source studied. Hydrologic analyses are typically performed at the watershed level. Depending on factors such as watershed size and shape, land use and urbanization, and natural or man-made storage, various models or methodologies may be applied. A summary of the hydrologic methods applied to develop the discharges used in the hydraulic analyses for each stream is provided in Table 13. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

A summary of the discharges is provided in Table 10. Frequency Discharge-Drainage Area Curves used to develop the hydrologic models may also be shown in Figure 7 for selected flooding sources. A summary of stillwater elevations developed for non-coastal flooding sources is provided in Table 11. (Coastal stillwater elevations are discussed in Section 5.3 and shown in Table 17.) Stream gage information is provided in Table 12.

Table 10: Summary of Discharges

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)					
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
Ackerman Creek	At the confluence with Russian River	20.6	3,190	*	4,800	5,370	*	7,000
Ackerman Creek	At Orrs Springs Road	19.0	3,060	*	4,700	5,320	*	6,600
Anderson Creek	At the confluence with Con Creek	35.4	5,230	*	8,060	9,140	*	11,800
Anderson Creek	Upstream of the confluence with Robinson Creek	24.0	3,670	*	5,730	6,520	*	8,460
Anderson Creek	Upstream of the confluence with Donelly Creek	21.7	3,360	*	5,240	5,970	*	7,750
Anderson Creek	At State Highway 253	14.3	2,280	*	3,630	4,150	*	5,460
Broaddus Creek	Above the confluence with Haehl/Baechtel Creek	7.9	1,380	*	2,260	2,620	*	3,530
Davis Creek	At Hearst-Willits Road	14.8	2,200	*	3,710	4,360	*	6,040
Doolin Creek	At confluence with Russian River	7.2	1,040	*	1,650	1,880	*	2,460

*Not calculated for this Flood Risk Project

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)					
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
Doolin Creek	Above the confluence with Gibson Creek	4.3	660	*	1,060	1,200	*	1,570
Doolin Creek	Above the confluence with Mendocino Creek	3.0	480	*	770	880	*	1,150
Doolin Creek	Above the confluence with Tributary near State Street	2.1	383	*	627	721	*	957
East Fork Russian River	0.3 miles downstream of Centerville Road	29.1	4,050	*	6,050	6,810	*	8,640
Eel River	At the confluence with Hale Creek	35.3	41,000	*	70,000	82,500	*	11,200
Feliz Creek	At the confluence with Russian River	43.3	5,990	*	8,230	9,160	*	11,470
Feliz Creek	At Old Hopland-Yorkville Road	31.1	4,550	*	6,290	7,040	*	8,940
Forsythe Creek	At the confluence with Russian River	49.7	6,940	*	10,500	11,900	*	15,200
Forsythe Creek	Upstream of the confluence with Seward Creek	34.6	5,120	*	7,900	8,960	*	11,600
Forsythe Creek	Upstream of the confluence with Bakers Creek	32.5	4,810	*	7,460	8,480	*	11,000

*Not calculated for this Flood Risk Project

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)					
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
Forsythe Creek	Upstream of the confluence with Mill Creek (at Redwood Valley)	18.7	3,070	*	4,790	5,450	*	7,060
Gibson Creek	At the confluence with Doolin Creek	2.9	466	*	748	854	*	1,120
Gibson Creek	At West Standley Street	1.5	266	*	459	538	*	743
Haehl/Baechtel Creek	At the downstream City of Willits corporate limits[1]	33.6	3,520	*	7,940	9,240	*	12,600
Haehl/Baechtel Creek	Above Broaddus Creek Low Flow Confluence[2]	23.9	2,450	*	5,800	6,740	*	9,160
Haehl/Baechtel Creek	Above Broaddus Creek 2-percent-annual-chance flow confluence[3]	16.0	2,450	*	4,070	6,740	*	9,160
Haehl/Baechtel Creek	Above Haehl Creek low flow confluence[4]	10.1	1,680	*	4,070	4,730	*	6,420

*Not calculated for this Flood Risk Project

[1]Includes Mill Creek (near Willits Drainage Area and Contributing Flows, Except for Mill Creek 10% Annual-Chance Peak Discharge

[2]Includes Broaddus Creek Drainage Area and Contributing Flows, Except for Broaddus Creek 10% Annual-Chance Peak Discharge

[3]1,750 Feet Upstream of Broaddus Creek Low Flow Confluence, Does Not Include Broaddus Creek 10% or 2% Annual-Chance Peak Discharges

[4]Does Not Include Haehl Creek 10% Annual-Chance Peak Discharges

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)					
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
Haehl/Baechtel Creek	Above Haehl Creek 0.2-percent-annual-chance flow confluence[1]	9.9	1,680	*	2,790	3,250	*	4,410
Haehl/Baechtel Creek	At the upstream Limit of Study	8.1	1,410	*	2,380	2,780	*	3,810
Hensley Creek	At the confluence with Russian River	7.6	1,290	*	1,970	2,210	*	2,790
Hensley Creek	2.1 miles upstream of U.S. Highway 101	3.7	661	*	1,070	1,230	*	1,630
Mill Creek (near Talmage)	At the confluence with Russian River	18.0	2,210	*	3,320	3,790	*	4,490
Mill Creek (near Talmage)	Above the confluence with McClure Creek	10.1	1,260	*	2,000	2,290	*	3,000
Mill Creek (near Talmage)	Above confluence with North Fork Mill Creek	4.4	610	*	990	1,140	*	1,520
Mill Creek (at Willits)	At the downstream City of Willits corporate limits	9.7	1,620	*	2,730	3,190	*	4,380
North Fork Mill Creek	At the confluence with Mill Creek	5.3	730	*	1,210	1,410	*	1,910
Noyo River	At U.S. Highway 1	114.0	17,740	*	31,085	38,000	*	57,367

*Not calculated for this Flood Risk Project

[1]880 Feet Upstream of Haehl Creek Low Flow Confluence, Does Not Include Haehl Creek Peak Discharges

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)					
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
Orrs Creek	At the confluence with Russian River	10.2	1,570	*	2,460	2,790	*	3,610
Orrs Creek	At Low Gap Park	7.9	1,350	*	2,190	2,530	*	3,360
Robinson Creek	At the confluence with Russian River	26.7	3,930	*	5,890	6,590	*	8,280
Robinson Creek	Upstream of the confluence with Unnamed Tributary near State Highway 253 Crossing	20.5	3,240	*	5,020	5,680	*	7,310
Robinson Creek	1.4 miles upstream of State Highway 253	16.3	2,620	*	4,150	4,720	*	6,210
Robinson Creek	2.2 miles upstream of State Highway 253	10.2	1,770	*	2,810	3,220	*	4,210
Russian River	At U.S. Highway 101 bridge south of Hopland	437	36,900	*	53,100	59,900	*	75,800
Russian River	Upstream of the confluence with Feliz Creek	391	32,700	*	47,100	53,000	*	67,100
Russian River	At USGS gaging station near Hopland (No. 11462500)	362	30,000	*	43,100	48,600	*	61,400

*Not calculated for this Flood Risk Project

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)					
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
Russian River	Downstream of the confluence with Robinson Creek	317	26,100	*	37,500	42,100	*	53,800
Russian River	Upstream of the confluence with Robinson Creek	291	23,100	*	33,300	37,300	*	46,800
Russian River	Upstream of the confluence with Doolin and Mill Creek (near Talmage)	261	19,600	*	28,300	31,700	*	39,700
Russian River	Upstream of the confluence with Orrs Creek	249	18,200	*	26,300	29,400	*	36,900
Russian River	Downstream of the confluence with Ackerman Creek	235	16,500	*	23,900	26,800	*	33,600
Russian River	Upstream of the confluence with Ackerman Creek	215	15,800	*	21,500	23,700	*	29,100
Russian River	Upstream of the confluence with Hensley Creek	207	14,800	*	21,100	22,200	*	27,200
Russian River	At USGS gaging station near Ukiah (No. 11461000)	99.7	14,400	*	19,700	21,700	*	26,800

*Not calculated for this Flood Risk Project

Flooding Source	Location	Drainage Area (Square Miles)	Peak Discharge (cfs)					
			10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance Existing	1% Annual Chance Future	0.2% Annual Chance
Russian River	Upstream of the confluence with Your Creek	87.0	12,700	*	17,300	19,200	*	23,600
Russian River	Upstream of the confluence with Forsythe Creek	35.0	5,310	*	7,620	8,480	*	10,600
Russian River	At upstream Limit of Detailed Study	27.1	4,480	*	6,400	7,120	*	8,900
Sulphur Creek	At Vicky springs Road	5.5	950	*	1,380	1,600	*	2,130
Tenmile Creek	0.2 mil downstream of Branscomb Road	20.9	3,440	*	5,850	6,900	*	9,620
Town Creek	At the confluence with Grist Creek	11.3	1,300	*	2,280	2,720	*	3,890
York Creek	At the confluence with Russian River	12.0	1,920	*	2,920	3,290	*	4,170
York Creek	2.1 miles upstream of U.S. Highway 101	8.0	1,270	*	2,080	2,410	*	3,220

*Not calculated for this Flood Risk Project

Figure 7: Frequency Discharge-Drainage Area Curves

[Not Applicable to this Flood Risk Project]

Table 11: Summary of Non-Coastal Stillwater Elevations

		Elevations (feet NAVD88)				
Flooding Source	Location	10% Annual Chance	4% Annual Chance	2% Annual Chance	1% Annual Chance	0.2% Annual Chance
Pacific Ocean	At Point Arena	8.2	*	8.6	8.7	9.0

*Not calculated for this Flood Risk Project

Table 12: Stream Gage Information used to Determine Discharges

Flooding Source	Gage Identifier	Agency that Maintains Gage	Site Name	Drainage Area (Square Miles)	Period of Record	
					From	To
Eel River	11472500	USGS	Above Dos Rios	705	1951	1965
Eel River	*	*	Near Dos Rios	528	1965	1977
Eel River	11471500	USGS	At Van Arsdale Reservoir	349	1910	1977
Feliz Creek	*	*	Near Hopland	31.1	1958	1966
Russian River	11461000	USGS	Near Redwood Valley	14.1	1964	1976
Russian River	11461000	USGS	Near Ukiah	99.7	1953	1976
Russian River	11462500	USGS	Near Hopland	362	1959	1979
Russian River	11463000	USGS	Near Cloverdale	503	1959	1979
Russian River	11464000	USGS	Near Healdsburg	793	1959	1976

*Data Not Available

5.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Base flood elevations on the FIRM represent the elevations shown on the Flood Profiles and in the Floodway Data tables in the FIS Report. Rounded whole-foot elevations may be shown on the FIRM in coastal areas, areas of ponding, and other areas with static base flood elevations. These whole-foot elevations may not exactly reflect the elevations derived from the hydraulic analyses. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to use the flood elevation data presented in this FIS Report in conjunction with the data shown on the FIRM. The hydraulic analyses for this FIS were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

For streams for which hydraulic analyses were based on cross sections, locations of selected cross sections are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 6.3), selected cross sections are also listed on Table 24, “Floodway Data.”

A summary of the methods used in hydraulic analyses performed for this project is provided in Table 13. Roughness coefficients are provided in Table 14. Roughness coefficients are values representing the frictional resistance water experiences when passing overland or through a channel. They are used in the calculations to determine water surface elevations. Greater detail (including assumptions, analysis, and results) is available in the archived project documentation.

Table 13: Summary of Hydrologic and Hydraulic Analyses

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Ackerman Creek	Confluence with Russian River	Approximately 123 feet upstream of Orr Springs Road	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	Regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. These regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. The equations were derived by applying multiple regression techniques to flood discharges and selected basin characteristics of gaging stations with records ranging in length from 5 to 87 years. The 10-, 2-, and 1-percent-annual-chance peak flood discharges at several locations on these detailed-study streams were calculated from these regional equations. The 0.2-percent-annual-chance peak flood discharges were calculated using a log-normal extrapolation based on the 2- and 1-percent-annual-chance values. The overbank portions of the cross section data for the detailed-study streams were obtained from topographic mapping and digitized ground elevation locations (Towill Corporation, September 1979(a)). Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogrammetric digitization. Bridge plans were utilized to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out-of-date. Cross sections for the backwater analyses were located at close intervals above and below structures to compute the significant backwater effects of these structures;

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Ackerman Creek, continued	Confluence with Russian River	Approximately 123 feet upstream of Orr Springs Road	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	appropriate valley cross sections were also included in the backwater analyses. WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed for all streams in the study through the use of the USACE HEC-2 step- backwater computer program (USACE August 1979). Roughness coefficients (Manning's "n") were chosen to calibrate the results of the computer modeling to high-water marks from the December 1964 flood (USACE, n.d. (b); USACE, n.d.(c); and USACE, December 1965). The starting WSELs were determined by the slope-area method, and option in the HEC-2 program (USACE, August 1979). In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow.
Anderson Creek	Approximately 1,800 feet downstream of confluence of Witherell Creek	Approximately 2,630 feet upstream of confluence of Soda Creek	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	Regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. These regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. The equations were derived by applying multiple regression techniques to flood discharges and selected basin characteristics of gaging stations with records ranging in length from 5 to 87 years. The 10-, 2-, and 1-percent-annual-chance peak flood discharges at several locations on these detailed-study streams were calculated from these regional equations. The 0.2-percent-annual-chance peak flood discharges were calculated

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Anderson Creek, continued	Approximately 1,800 feet downstream of confluence of Witherell Creek	Approximately 2,630 feet upstream of confluence of Soda Creek	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	using a log-normal extrapolation based on the 2- and 1-percent-annual-chance values. The overbank portions of the cross section data for the detailed-study streams were obtained from topographic mapping and digitized ground elevation locations (Towill Corporation, September 1979(a)). Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogrammetric digitization. Bridge plans were utilized to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out-of-date. Cross sections for the backwater analyses were located at close intervals above and below structures to compute the significant backwater effects of these structures; appropriate valley cross sections were also included in the backwater analyses. WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed for all streams in the study through the use of the USACE HEC-2 step- backwater computer program (USACE August 1979). The starting WSELs were determined by the slope-area method, and option in the HEC-2 program (USACE, August 1979). In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Broaddus Creek	Confluence with Haehl/Baechtel Creek	Approximately 2,333 feet upstream of Main Street/U.S. Highway 101	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE	The 10-, 2-, and 1-percent-annual-chance peak discharges were generated by applying regional flood-frequency equations (USGS, June 1977). These equations relate discharges with return periods of 10-, 2-, and 1-percent-annual-chance to drainage area, mean annual precipitation, and altitude index. The equations were derived by applying multiple-regression techniques to flow data and basin characteristics of several gaging stations in the north coast region of California. The 10-, 2-, and 1-percent-annual-chance discharge was calculated at each site by extrapolation from the other three frequency data points. The overbank portions of the cross section data for Haehl/Baechtel, Broaddus, and Mill (at Willits) Creeks were obtained from topographic mapping and digitized ground elevation locations (Towill Corporation, September 1979(c)). Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogrammetric digitization. Bridge plans were used to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out-of-date. Cross sections for the backwater analyses were located at close intervals above and below structures in order to compute the significant backwater effects of these structures in the developed areas. In long reaches between structures, appropriate valley cross sections were also included in the backwater analyses.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Broaddus Creek, continued	Confluence with Haehl/Baechtel Creek	Approximately 2,333 feet upstream of Main Street/U.S. Highway 101	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE	WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed for all streams in the study through the use of the USACE HEC-2 step- backwater computer program (USACE, August 1979). Roughness coefficients (Manning's "n") for the streams were chosen to calibrate the results of the computer model to high-water marks from the December 1964 flood (USACE, n.d.(b); USACE December 1965). The starting WSELs for each of the streams were determined by the slope- area method, an option in the HEC-2 program (USACE, August 1979). In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow. The shallow flooding area was determined to be inundated by flooding of less than 1.0 foot in depth, based on engineering judgment.
Davis Creek	At Hearst-Willts Road	Approximately 1 mile upstream of Hearst-Willts Road	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	Regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. These regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. The equations were derived by applying multiple regression techniques to flood discharges and selected basin characteristics of gaging stations with records ranging in length from 5 to 87 years. The 10-, 2-, and 1-percent-annual-chance peak flood discharges at several locations on these detailed-study streams were calculated from these regional equations. The 0.2-percent-annual-chance peak flood discharges were calculated using a

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Davis Creek, continued	At Hearst-Willts Road	Approximately 1 mile upstream of Hearst-Willts Road	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	log-normal extrapolation based on the 2- and 1-percent-annual-chance values. The overbank portions of the cross section data for the detailed-study streams were obtained from topographic mapping and digitized ground elevation locations (Towill Corporation, September 1979(a)). Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogrammetric digitization. Bridge plans were utilized to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out-of-date. Cross sections for the backwater analyses were located at close intervals above and below structures to compute the significant backwater effects of these structures; appropriate valley cross sections were also included in the backwater analyses. WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed for all streams in the study through the use of the USACE HEC-2 step- backwater computer program (USACE August 1979). Roughness coefficients (Manning's "n") were chosen to calibrate the results of the computer modeling to high-water marks from the December 1964 flood (USACE, n.d. (b); USACE, n.d.(c); and USACE, December 1965). The starting WSELs were determined by the slope-area method, and option in the HEC-2 program (USACE, August 1979).

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Davis Creek, continued	At Hearst-Willts Road	Approximately 1 mile upstream of Hearst-Willts Road	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow.
Doolin Creek	Approximately 310 feet downstream of U.S. Highway 101 Northbound	Approximately 375 feet upstream of Helen Avenue/ Upstream Drive	Regional flood-frequency equations	USACE HEC-2 step-backwater computer program	*	AE w/ Floodway	The 10-, 2-, 1-, and 0.2-percent-annual-chance peak discharges used in studying Doolin Creek was generated by applying regional flood-frequency equations (USGS, June 1977). These equations relate discharges with return periods of 10, 2, and 1-percent-annual-chance to drainage area, mean annual precipitation, and altitude index. The equations were derived by applying multiple regression techniques to the flow data and basin characteristics of several gaging stations in the north coast region of California. The 10-, 2-, and 1-percent-annual-chance peak discharges at several sites on the streams were calculated from the regional equations. A 0.2-percent-annual-chance discharge was calculated at each site by extrapolation from the other three frequency data points. The overbank portions of the cross section data for Orrs, Gibson, and Doolin Creeks, and the Russian River were obtained from topographic mapping (Towill Corporation, September 1979(b)) and digitized ground elevation locations, except on Orrs Creek between U.S. Highway 101 and Ford Street, where the overbank portions were field surveyed.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Doolin Creek, continued	Approximately 310 feet downstream of U.S. Highway 101 Northbound	Approximately 375 feet upstream of Helen Avenue/ Upstream Drive	Regional flood-frequency equations	USACE HEC-2 step-backwater computer program	*	AE w/ Floodway	Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogram-metric digitization. Bridge plans were used to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out of date. Cross sections for the backwater analyses were located at close intervals above and below structures in order to compute the significant backwater effects of these structures in the developed areas. In long reaches between structures, appropriate valley cross sections were also included in the backwater analyses. WSELs of 10-, 2-, and 0,2-percent-annual-chance floods were computed through the use of the USACE HEC-2 step-backwater computer program (USACE, August 1979). Roughness coefficients (Manning's "n") were chosen to calibrate the results of the computer model to high-water marks from the December 1964 flood (USACE, n.d.(c); USACE, December 1965). The starting water-surface elevations for each of the streams were determined by the slope-area method, an option in the HEC-2 program (USACE, August 1979). In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
East Fork Russian River	Approximately 1,800 feet downstream of Main Street	Approximately 1,470 feet upstream of confluence with Williams Creek	Log-Pearson Type III	USACE HEC-2 step-backwater	*	AE w/ Floodway	Regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. These regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. The equations were derived by applying multiple regression techniques to flood discharges and selected basin characteristics of gaging stations with records ranging in length from 5 to 87 years. The 10-, 2-, and 1-percent-annual-chance peak flood discharges at several locations on these detailed-study streams were calculated from these regional equations. The 0.2-percent-annual-chance peak flood discharges were calculated using a log-normal extrapolation based on the 2- and 1-percent-annual-chance values. Analysis of floodflows for the East Fork Russian River included the diversion of 300 cfs from the Eel River at Van Arsdale Reservoir to the upper reaches of the East Fork Russian River. For each of the selected flood events, 300 cfs was added to the East Fork Russian River flows. The overbank portions of the cross section data for the detailed-study streams were obtained from topographic mapping and digitized ground elevation locations (Towill Corporation, September 1979(a)). Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogrammetric digitization. Bridge plans were utilized to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out-of-date.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
East Fork Russian River, continued	Approximately 1,800 feet downstream of Main Street	Approximately 1,470 feet upstream of confluence with Williams Creek	Log-Pearson Type III	USACE HEC-2 step-backwater	*	AE w/ Floodway	Cross sections for the backwater analyses were located at close intervals above and below structures to compute the significant backwater effects of these structures; appropriate valley cross sections were also included in the backwater analyses. WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed for all streams in the study through the use of the USACE HEC-2 step- backwater computer program (USACE August 1979). Roughness coefficients (Manning's "n") were chosen to calibrate the results of the computer modeling to high-water marks from the December 1964 flood (USACE, n.d. (b); USACE, n.d.(c); and USACE, December 1965). The starting WSELs were determined by the slope-area method, and option in the HEC-2 program (USACE, August 1979). In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow.
Eel River	Approximately 1.85 miles downstream of Cape Horn Dam	Approximately 30 feet upstream of Eel River Road	Log-Pearson Type III	USACE HEC-2 step-backwater	*	AE w/ Floodway	Peak discharge records at gaging stations were used to determine the 10-, 2-, 1-, and 0.2-percent-annual-chance floodflows using a log-Pearson Type III analysis in accordance with U.S. Water Resources Council (USWRC) guidelines (USWRC, June 1977). To determine peak floodflows at locations upstream or downstream from a gaging station, the station's log- Pearson Type III values were transposed.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Eel River, continued	Approximately 1.85 miles downstream of Cape Horn Dam	Approximately 30 feet upstream of Eel River Road	Log-Pearson Type III	USACE HEC-2 step-backwater	*	AE w/ Floodway	The length of record at the gage was adjusted for weighting purposes in accordance with the difference in drainage area between the gage and point of interest. The gage was given no weight if the area at the site was greater than three times the watershed area or less than one-third of the area at the gage. The regional equations were also used to determine the location site's flood-frequency values and were weighted according to the equivalent years of record for each return period. For locations between two gages, a final weighted flow value was based on three separate estimates: the upstream transposed gage, the downstream transposed gage, and the regional equations (USGS, May 1975). Analysis of floodflows for the Eel River included the diversion of 300 cfs from the Eel River at Van Arsdale Reservoir to the upper reaches of the East Fork Russian River. For each of the selected flood events, 300 cfs was subtracted from the Eel River flows below the Van Arsdale Reservoir. The overbank portions of the cross section data for the detailed-study streams were obtained from topographic mapping and digitized ground elevation locations (Towill Corporation, September 1979(a)). Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogrammetric digitization. Bridge plans were utilized to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out-of-date.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Eel River, continued	Approximately 1.85 miles downstream of Cape Horn Dam	Approximately 30 feet upstream of Eel River Road	Log-Pearson Type III	USACE HEC-2 step-backwater	*	AE w/ Floodway	Cross sections for the backwater analyses were located at close intervals above and below structures to compute the significant backwater effects of these structures; appropriate valley cross sections were also included in the backwater analyses. WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed for all streams in the study through the use of the USACE HEC-2 step- backwater computer program (USACE August 1979).
Feliz Creek	Confluence with Russian River	Approximately 94 feet upstream of Old Hopland-Yorkville Road	Log-Pearson Type III	USACE HEC-2 step-backwater	*	AE w/ Floodway	Peak discharge records at gaging stations were used to determine the 10-, 2-, 1-, and 0.2-percent-annual-chance floodflows using a log-Pearson Type III analysis in accordance with U.S. Water Resources Council (USWRC) guidelines (USWRC, June 1977). To determine peak floodflows at locations upstream or downstream from a gaging station, the station’s log- Pearson Type III values were transposed. The length of record at the gage was adjusted for weighting purposes in accordance with the difference in drainage area between the gage and point of interest. The gage was given no weight if the area at the site was greater than three times the watershed area or less than one-third of the area at the gage. The regional equations were also used to determine the location site's flood-frequency values and were weighted according to the equivalent years of record for each return period. For locations between two gages, a final weighted flow value was based on three separate estimates: the upstream transposed gage, the downstream transposed gage, and the regional equations (USGS, May 1975).

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Feliz Creek, continued	Confluence with Russian River	Approximately 94 feet upstream of Old Hopland-Yorkville Road	Log-Pearson Type III	USACE HEC-2 step-backwater	*	AE w/ Floodway	The overbank portions of the cross section data for the detailed-study streams were obtained from topographic mapping and digitized ground elevation locations (Towill Corporation, September 1979(a)). Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogrammetric digitization. Bridge plans were utilized to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out-of-date. Cross sections for the backwater analyses were located at close intervals above and below structures to compute the significant backwater effects of these structures; appropriate valley cross sections were also included in the backwater analyses. WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed for all streams in the study through the use of the USACE HEC-2 step- backwater computer program (USACE August 1979). Roughness coefficients (Manning's "n") were chosen to calibrate the results of the computer modeling to high-water marks from the December 1964 flood (USACE, n.d. (b); USACE, n.d.(c); and USACE, December 1965). The starting WSELs were determined by the slope-area method, and option in the HEC-2 program (USACE, August 1979). In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Forsythe Creek	Confluence with Russian River	Approximately 65 feet upstream of Reeves Canyon Road	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	Regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. These regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. The equations were derived by applying multiple regression techniques to flood discharges and selected basin characteristics of gaging stations with records ranging in length from 5 to 87 years. The 10-, 2-, and 1-percent-annual-chance peak flood discharges at several locations on these detailed-study streams were calculated from these regional equations. The 0.2-percent-annual-chance peak flood discharges were calculated using a log-normal extrapolation based on the 2- and 1-percent-annual-chance values. The overbank portions of the cross section data for the detailed-study streams were obtained from topographic mapping and digitized ground elevation locations (Towill Corporation, September 1979(a)). Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogrammetric digitization. Bridge plans were utilized to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out-of-date. Cross sections for the backwater analyses were located at close intervals above and below structures to compute the significant backwater effects of these structures; appropriate valley cross sections were also included in the backwater analyses.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Forsythe Creek	Confluence with Russian River	Approximately 65 feet upstream of Reeves Canyon Road	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed through the use of the USACE HEC-2 step- backwater computer program (USACE August 1979). Roughness coefficients (Manning's "n") were chosen to calibrate the results of the computer modeling to high-water marks from the December 1964 flood (USACE, n.d. (b); USACE, n.d.(c); and USACE, December 1965). The starting WSELs were determined by the slop-area method, and option in the HEC-2 program (USACE, August 1979). In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow.
Gibson Creek	Approximately 1,770 feet downstream of U.S. Highway 101	Approximately 850 feet upstream of Standley Street	Regional flood-frequency equations	USACE HEC-2 step-backwater computer program	*	AE w/ Floodway	The 10-, 2-, 1-, and 0.2-percent-annual-chance peak discharges used in studying Gibson Creek were generated by applying regional flood-frequency equations (USGS, June 1977). These equations relate discharges with return periods of 10, 2, and 1-percent-annual-chance to drainage area, mean annual precipitation, and altitude index. The equations were derived by applying multiple regression techniques to the flow data and basin characteristics of several gaging stations in the north coast region of California. The 10-, 2-, and 1-percent-annual-chance peak discharges at several sites on the streams were calculated from the regional equations. A 0.2-percent-annual-chance discharge was calculated at each site by extrapolation from the other three frequency data points.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Gibson Creek	Approximately 1,770 feet downstream of U.S. Highway 101	Approximately 850 feet upstream of Standley Street	Regional flood-frequency equations	USACE HEC-2 step-backwater computer program	*	AE w/ Floodway	The overbank portions of the cross section data for Orrs, Gibson, and Doolin Creeks, and the Russian River were obtained from topographic mapping (Towill Corporation, September 1979(b)) and digitized ground elevation locations, except on Orrs Creek between U.S. Highway 101 and Ford Street, where the overbank portions were field surveyed. Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogram-metric digitization. Bridge plans were used to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out of date. Cross sections for the backwater analyses were located at close intervals above and below structures in order to compute the significant backwater effects of these structures in the developed areas. In long reaches between structures, appropriate valley cross sections were also included in the backwater analyses. WSELs of 10-, 2-, and 0,2-percent-annual-chance floods were computed through the use of the USACE HEC-2 step-backwater computer program (USACE, August 1979). Roughness coefficients (Manning's "n") were chosen to calibrate the results of the computer model to high-water marks from the December 1964 flood (USACE, n.d.(c); USACE, December 1965). The starting water-surface elevations for each of the streams were determined by the slope-area method, an option in the HEC-2 program (USACE, August 1979).

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Gibson Creek, continued	Approximately 1,770 feet downstream of U.S. Highway 101	Approximately 850 feet upstream of Standley Street	Regional flood-frequency equations	USACE HEC-2 step-backwater computer program	*	AE w/ Floodway	Roughness coefficients (Manning's "n") were chosen to calibrate the results of the computer modeling to high-water marks from the December 1964 flood (USACE, n.d.(b); USACE, n.d.(c); and USACE, December 1965). In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow. Gibson Creek flood elevations area controlled by the Russian River.
Gaulala River	Approximately 0.5 miles downstream of Coast Highway/ State Route 1	Approximately 140 feet upstream of Coast Highway/ State Route 1	*	USACE HEC-2 step-backwater	*	AE	The hydraulics of flooding on the Gualala River were originally attributed to the occurrence of high ocean water levels that would back up riverflow at the mouth. Field surveys and hydraulic analyses established that the sand spit at the mouth was formed by wave action and its elevation exceeded the maximum Stillwater ocean level plus wave setup. Tsunami would not affect the Gualala River because a sand spit protects the study area. The maximum WSEL of the Gualala River was determined by treating the blocking sand spit as a broad-crested weir during flood events on the stream. The sand spit at the mouth of the Gualala River is assumed to back up flooding from the Gualala River just before breaching. Actual ocean levels at the time of breach have no influence on water-surface elevations from the Gualala River. The water level so produced was consistent with local observations and was used in the delineation of flooding (Ott Water Engineers, Inc., August 1984).

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Haehl/Baechtel Creek	Approximately 360 feet downstream of confluence with Broaddus Creek	Approximately 2,020 feet upstream of confluence of Baechtel Creek Tributary A	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	The 10-, 2-, and 1-percent-annual-chance peak discharges were generated by applying regional flood-frequency equations (USGS, June 1977). These equations relate discharges with return periods of 10-, 2-, and 1-percent-annual-chance to drainage area, mean annual precipitation, and altitude index. The equations were derived by applying multiple-regression techniques to flow data and basin characteristics of several gaging stations in the north coast region of California. The 10-, 2-, and 1-percent-annual-chance discharge was calculated at each site by extrapolation from the other three frequency data points. The overbank portions of the cross section data for Haehl/Baechtel, Broaddus, and Mill (at Willits) Creeks were obtained from topographic mapping and digitized ground elevation locations (Towill Corporation, September 1979(c)). Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogrammetric digitization. Bridge plans were used to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out-of-date. Cross sections for the backwater analyses were located at close intervals above and below structures in order to compute the significant backwater effects of these structures in the developed areas. In long reaches between structures, appropriate valley cross sections were also included in the backwater analyses.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Haehl/Baechtel Creek, continued	Approximately 360 feet downstream of confluence with Broaddus Creek	Approximately 2,020 feet upstream of confluence of Baechtel Creek Tributary A	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed for all streams in the study through the use of the USACE HEC-2 step- backwater computer program (USACE, August 1979). Roughness coefficients (Manning's "n") for the streams were chosen to calibrate the results of the computer model to high-water marks from the December 1964 flood (USACE, n.d.(b); USACE December 1965). The starting WSELs were determined by the slope- area method, an option in the HEC-2 program (USACE, August 1979). In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow.
Hensley Creek	Confluence with Russian River	Approximately 0.97 miles upstream of Unnamed Road	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	Regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. These regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. The equations were derived by applying multiple regression techniques to flood discharges and selected basin characteristics of gaging stations with records ranging in length from 5 to 87 years. The 10-, 2-, and 1-percent-annual-chance peak flood discharges at several locations on these detailed-study streams were calculated from these regional equations. The 0.2-percent-annual-chance peak flood discharges were calculated using a log-normal extrapolation based on the 2- and 1-percent-annual-chance values.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Hensley Creek, continued	Confluence with Russian River	Approximately 0.97 miles upstream of Unnamed Road	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	The overbank portions of the cross section data for the detailed-study streams were obtained from topographic mapping and digitized ground elevation locations (Towill Corporation, September 1979(a)). Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogrammetric digitization. Bridge plans were utilized to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out-of-date. Cross sections for the backwater analyses were located at close intervals above and below structures to compute the significant backwater effects of these structures; appropriate valley cross sections were also included in the backwater analyses. WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed for all streams in the study through the use of the USACE HEC-2 step- backwater computer program (USACE August 1979). Roughness coefficients (Manning's "n") were chosen to calibrate the results of the computer modeling to high-water marks from the December 1964 flood (USACE, n.d. (b); USACE, n.d.(c); and USACE, December 1965). The starting WSELs were determined by the slop-area method, and option in the HEC-2 program (USACE, August 1979). In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Mill Creek (at Redwood Creek)	Confluence with Forsythe Creek	Approximately 27 feet upstream of Reeves Canyon Road	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	Regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. These regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. The equations were derived by applying multiple regression techniques to flood discharges and selected basin characteristics of gaging stations with records ranging in length from 5 to 87 years. The 10-, 2-, and 1-percent-annual-chance peak flood discharges at several locations on these detailed-study streams were calculated from these regional equations. The 0.2-percent-annual-chance peak flood discharges were calculated using a log-normal extrapolation based on the 2- and 1-percent-annual-chance values. The overbank portions of the cross section data for the detailed-study streams were obtained from topographic mapping and digitized ground elevation locations (Towill Corporation, September 1979(a)). Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogrammetric digitization. Bridge plans were utilized to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out-of-date. Cross sections for the backwater analyses were located at close intervals above and below structures to compute the significant backwater effects of these structures; appropriate valley cross sections were also included in the backwater analyses.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Mill Creek (at Redwood Creek), continued	Confluence with Forsythe Creek	Approximately 27 feet upstream of Reeves Canyon Road	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed for all streams in the study through the use of the USACE HEC-2 step- backwater computer program (USACE August 1979). The starting WSELs were determined by the slop-area method, and option in the HEC-2 program (USACE, August 1979). In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow.
Mill Creek (near Talmage)	Approximately 800 feet downstream of confluence of McClure Creek	Approximately 0.4 miles upstream of confluence of North Fork Mill Creek	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	Regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. These regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. The equations were derived by applying multiple regression techniques to flood discharges and selected basin characteristics of gaging stations with records ranging in length from 5 to 87 years. The 10-, 2-, and 1-percent-annual-chance peak flood discharges at several locations on these detailed-study streams were calculated from these regional equations. The 0.2-percent-annual-chance peak flood discharges were calculated using a log-normal extrapolation based on the 2- and 1-percent-annual-chance values. The overbank portions of the cross section data for the detailed-study streams were obtained from topographic mapping and digitized ground elevation locations (Towill Corporation, September 1979(a)).

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Mill Creek (near Talmage), continued	Approximately 800 feet downstream of confluence of McClure Creek	Approximately 0.4 miles upstream of confluence of North Fork Mill Creek	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogrammetric digitization. Bridge plans were utilized to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out-of-date. Cross sections for the backwater analyses were located at close intervals above and below structures to compute the significant backwater effects of these structures; appropriate valley cross sections were also included in the backwater analyses. WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed for all streams in the study through the use of the USACE HEC-2 step- backwater computer program (USACE August 1979). Roughness coefficients (Manning's "n") were chosen to calibrate the results of the computer modeling to high-water marks from the December 1964 flood (USACE, n.d. (b); USACE, n.d.(c); and USACE, December 1965). The starting WSELs were determined by the slop-area method, and option in the HEC-2 program (USACE, August 1979). In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Mill Creek (at Willits)	Approximately 700 feet downstream of Little Lake Industrial Downstream Lumberyard Bridge	Approximately 0.45 miles upstream of Mill Creek Drive	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	The 10-, 2-, and 1-percent-annual-chance peak discharges were generated by applying regional flood-frequency equations (USGS, June 1977). These equations relate discharges with return periods of 10-, 2-, and 1-percent-annual-chance to drainage area, mean annual precipitation, and altitude index. The equations were derived by applying multiple-regression techniques to flow data and basin characteristics of several gaging stations in the north coast region of California. The 10-, 2-, and 1-percent-annual-chance discharge was calculated at each site by extrapolation from the other three frequency data points. The overbank portions of the cross section data for Haehl/Baechtel, Broaddus, and Mill (at Willits) Creeks were obtained from topographic mapping and digitized ground elevation locations (Towill Corporation, September 1979(c)). Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogrammetric digitization. Bridge plans were used to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out-of-date. Cross sections for the backwater analyses were located at close intervals above and below structures in order to compute the significant backwater effects of these structures in the developed areas. In long reaches between structures, appropriate valley cross sections were also included in the backwater analyses.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Mill Creek (at Willits), continued	Approximately 700 feet downstream of Little Lake Industrial Downstream Lumberyard Bridge	Approximately 0.45 miles upstream of Mill Creek Drive	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed for all streams in the study through the use of the USACE HEC-2 step- backwater computer program (USACE, August 1979). Roughness coefficients (Manning's "n") for the streams were chosen to calibrate the results of the computer model to high-water marks from the December 1964 flood (USACE, n.d.(b); USACE December 1965). Roughness coefficients (Manning's "n") were chosen to calibrate the results of the computer modeling to high-water marks from the December 1964 flood (USACE, n.d. (b); USACE, n.d.(c); and USACE, December 1965). The starting WSELs for each of the streams were determined by the slope- area method, an option in the HEC-2 program (USACE, August 1979). In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow.
North Fork Mill Creek (at Willits)	Confluence with Mill Creek (Near Talmage)	Approximately 794 feet upstream of Guidiville Reservation Road	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	Regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. These regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. The equations were derived by applying multiple regression techniques to flood discharges and selected basin characteristics of gaging stations with records ranging in length from 5 to 87 years.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
North Fork Mill Creek (at Willits), continued	Confluence with Mill Creek (Near Talmage)	Approximately 794 feet upstream of Guidiville Reservation Road	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	The 10-, 2-, and 1-percent-annual-chance peak flood discharges at several locations on these detailed-study streams were calculated from these regional equations. The 0.2-percent-annual-chance peak flood discharges were calculated using a log-normal extrapolation based on the 2- and 1-percent-annual-chance values. The overbank portions of the cross section data were obtained from topographic mapping and digitized ground elevation locations (Towill Corporation, September 1979 (a)). Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogrammetric digitization. Bridge plans were utilized to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out-of-date. Cross sections for the backwater analyses were located at close intervals above and below structures to compute the significant backwater effects of these structures; appropriate valley cross sections were also included in the backwater analyses. WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed through the use of the USACE HEC-2 step-backwater computer program (USACE August 1979). The starting WSEL was set equal to the WSEL of Mill Creek (near Talmage) at their confluence.. The two streams are of equal size at the confluence and it is likely that peak discharges will occur on both creeks at the same time. For this reason, the assumption of equal WSELs at their confluence was made.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
North Fork Mill Creek (at Willits), continued	Confluence with Mill Creek (Near Talmage)	Approximately 794 feet upstream of Guidiville Reservation Road	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow.
Noyo River	Approximately 455 feet downstream of Highway 1	Approximately 1.4 miles upstream of Highway 1	Log-Pearson Type III flood-frequency analysis	USACE HEC-2 step-backwater	4/17/2015	AE	The 1-percent-annual-chance discharge was computed from 32 years of USGS stream gage record. The stream gage is located approximately 0.2 miles east of the upstream project boundary. The 1-percent-annual-chance flood discharge was computed adjusting the predicted flood at the gage using area-transfer regional USACE coefficients from Waananen and Crippen. The USGS considers the record to be good and there are no diversions or regulations above the stream gage. Cross-section data for the backwater analysis were obtained from topographic maps compiled from aerial photography, and bathymetric maps compiled from bathymetric surveys conducted as a part of channel maintenance dredging. Geometry of the Highway 1 bridge was obtained from construction drawings for the bridge. Water-surface elevations (SWELs) for the 1-percent-annual-chance flood were computed using the USACE HEC-2 step-backwater computer program (USACE, August 1979). The starting water-surface elevation at the mouth of the Noyo river was taken as Mean Higher water, elevation 6.0 feet North American Vertical Datum of 1988 (NAVD 88). This elevation did not control the backwater calculation.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Orrs Creek	Approximately 85 feet downstream of US Highway 101	Approximately 1,652 feet upstream of Low Gap Park Bridge	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	These equations relate discharges with return periods of 10, 2, and 1-percent-annual-chance to drainage area, mean annual precipitation, and altitude index. The equations were derived by applying multiple regression techniques to the flow data and basin characteristics of several gaging stations in the north coast region of California. The 10-, 2-, and 1-percent-annual-chance peak discharges at several sites on the streams were calculated from the regional equations. A 0.2-percent-annual-chance discharge was calculated at each site by extrapolation from the other three frequency data points. The overbank portions of the cross section data were obtained from topographic mapping and digitized ground elevation locations (Towill Corporation, September 1979 (a)). Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogrammetric digitization. Bridge plans were utilized to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out-of-date. Cross sections for the backwater analyses were located at close intervals above and below structures to compute the significant backwater effects of these structures; appropriate valley cross sections were also included in the backwater analyses. WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed through the use of the USACE HEC-2 step-backwater computer program (USACE August 1979).

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Orrs Creek	Approximately 85 feet downstream of US Highway 101	Approximately 1,652 feet upstream of Low Gap Park Bridge	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	Roughness coefficients (Manning's "n"0 were chosen to calibrate the results of the computer modeling to high-water marks from the December 1964 flood (USACE, n.d.(b); USACE, n.d.(c); and USACE, December 1965). The starting WSELs were determined by the slop-area method, an option in the HEC-2 program (USACE, August 1979). In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow.
Robinson Creek	Approximately 860 feet downstream of US Highway 101 Northbound	Approximately 160 feet upstream of Robinson Creek Road	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	Regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. These regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. The equations were derived by applying multiple regression techniques to flood discharges and selected basin characteristics of gaging stations with records ranging in length from 5 to 87 years. The 10-, 2-, and 1-percent-annual-chance peak flood discharges at several locations on these detailed-study streams were calculated from these regional equations. The 0.2-percent-annual-chance peak flood discharges were calculated using a log-normal extrapolation based on the 2- and 1-percent-annual-chance values. The overbank portions of the cross section data were obtained from topographic mapping and digitized ground elevation locations (Towill Corporation, September 1979 (a)).

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Robinson Creek, continued	Approximately 860 feet downstream of US Highway 101 Northbound	Approximately 160 feet upstream of Robinson Creek Road	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogrammetric digitization. Bridge plans were utilized to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out-of-date. Cross sections for the backwater analyses were located at close intervals above and below structures to compute the significant backwater effects of these structures; appropriate valley cross sections were also included in the backwater analyses. WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed through the use of the USACE HEC-2 step-backwater computer program (USACE August 1979). Roughness coefficients (Manning's "n"0 were chosen to calibrate the results of the computer modeling to high-water marks from the December 1964 flood (USACE, n.d.(b); USACE, n.d.(c); and USACE, December 1965). The starting WSELs were determined by the slop-area method, an option in the HEC-2 program (USACE, August 1979). In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Russian River	Approximately 100 feet downstream of US Highway 101	Approximately 1,197 feet upstream of School Way	Log-Pearson Type III	HEC-2 step-backwater computer program	*	AE w/ Floodway	Peak discharge records at gaging stations were used to determine the 10-, 2-, 1-, and 0.2-percent-annual-chance floodflows using a log-Pearson Type III analysis in accordance with U.S. Water Resources Council (USWRC) guidelines (USWRC, June 1977). To determine peak floodflows at locations upstream or downstream from a gaging station, the station's log- Pearson Type III values were transposed. The length of record at the gage was adjusted for weighting purposes in accordance with the difference in drainage area between the gage and point of interest. The gage was given no weight if the area at the site was greater than three times the watershed area or less than one-third of the area at the gage. The regional equations were also used to determine the location site's flood-frequency values and were weighted according to the equivalent years of record for each return period. For locations between two gages, a final weighted flow value was based on three separate estimates: the upstream transposed gage, the downstream transposed gage, and the regional equations (USGS, May 1975). Analysis of the floodflows on the Russian River takes into account the release operation policy of the USACE for Lake Mendocino. This reservoir on the East Fork Russian River delays and decreases the size of the floods from the East Fork Russian River. The release operation policy results in no addition to the peak flows of the mainstream of the Russian River from the East Fork Russian River, as these flows are held in the reservoir until after the peak on the main stem has passed the confluence (USACE, June 1956).

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Russian River, continued	Approximately 100 feet downstream of US Highway 101	Approximately 1,197 feet upstream of School Way	Log-Pearson Type III	HEC-2 step-backwater computer program	*	AE w/ Floodway	Thus, for the Russian Rivers the drainage area of the East Fork Russian River was not included in the flood-frequency analysis. The overbank portions of the cross section data were obtained from topographic mapping (Towill Corporation, September 1979(b)) and digitized ground elevation locations. Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogram-metric digitization. Bridge plans were used to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out of date. Cross sections for the backwater analyses were located at close intervals above and below structures in order to compute the significant backwater effects of these structures in the developed areas. In long reaches between structures, appropriate valley cross sections were also included in the backwater analyses. WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed for all streams in the study through the use of the USACE HEC-2 step- backwater computer program (USACE, August 1979). Roughness coefficients (Manning's “n") for the streams were chosen to calibrate the results of the computer model to high-water marks from the December 1964 flood (USACE, n.d.(c); USACE, December 1965).

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Russian River, continued	Approximately 100 feet downstream of US Highway 101	Approximately 1,197 feet upstream of School Way	Log-Pearson Type III	HEC-2 step-backwater computer program	*	AE w/ Floodway	For the Russian River, the rating curves of two USGS gaging stations within Mendocino County were also used to determine roughness coefficients for the channel and overbanks. The starting water-surface elevations for each of the streams were determined by the slope-area method, an option in the HEC-2 program (USACE, August 1979). In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow.
Tenmile Creek	Approximately 1,040 feet downstream of Branscomb Road	Approximately 415 feet upstream of confluence of Cahto Creek	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	Regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. These regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. The equations were derived by applying multiple regression techniques to flood discharges and selected basin characteristics of gaging stations with records ranging in length from 5 to 87 years. The 10-, 2-, and 1-percent-annual-chance peak flood discharges at several locations on these detailed-study streams were calculated from these regional equations. The 0.2-percent-annual-chance peak flood discharges were calculated using a log-normal extrapolation based on the 2- and 1-percent-annual-chance values. The overbank portions of the cross section data were obtained from topographic mapping (Towill Corporation, September 1979(b)) and digitized ground elevation locations.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Tenmile Creek, continued	Approximately 1,040 feet downstream of Branscomb Road	Approximately 415 feet upstream of confluence of Cahto Creek	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogrammetric digitization. Bridge plans were used to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out of date. Cross sections for the backwater analyses were located at close intervals above and below structures in order to compute the significant backwater effects of these structures in the developed areas. In long reaches between structures, appropriate valley cross sections were also included in the backwater analyses. WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed for all streams in the study through the use of the USACE HEC-2 step- backwater computer program (USACE, August 1979). The starting water-surface elevations for each of the streams were determined by the slope-area method, an option in the HEC-2 program (USACE, August 1979). In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Town Creek	Confluence with Grist Creek	Approximately 0.6 miles upstream of Covelo Road / State Highway 162	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	Regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. These regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. The equations were derived by applying multiple regression techniques to flood discharges and selected basin characteristics of gaging stations with records ranging in length from 5 to 87 years. The 10-, 2-, and 1-percent-annual-chance peak flood discharges at several locations on these detailed-study streams were calculated from these regional equations. The 0.2-percent-annual-chance peak flood discharges were calculated using a log-normal extrapolation based on the 2- and 1-percent-annual-chance values. The overbank portions of the cross section data were obtained from topographic mapping (Towill Corporation, September 1979(b)) and digitized ground elevation locations. Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogram-metric digitization. Bridge plans were used to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out of date. Cross sections for the backwater analyses were located at close intervals above and below structures in order to compute the significant backwater effects of these structures in the developed areas. In long reaches between structures, appropriate valley cross sections were also included in the backwater analyses.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
Town Creek, continued	Confluence with Grist Creek	Approximately 0.6 miles upstream of Covelo Road / State Highway 162	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed for all streams in the study through the use of the USACE HEC-2 step- backwater computer program (USACE, August 1979). Roughness coefficients (Manning's "n") for the streams were chosen to calibrate the results of the computer model to high-water marks from the December 1964 flood (USACE, n.d.(c); USACE, December 1965). The starting water-surface elevations for each of the streams were determined by the slope-area method, an option in the HEC-2 program (USACE, August 1979). In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow.
York Creek	Confluence with Russian River	Approximately 2 miles upstream of US Highway 101 Southbound	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	Regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. These regional equations relate flows of various return periods to drainage area, mean annual precipitation, and watershed altitude. The equations were derived by applying multiple regression techniques to flood discharges and selected basin characteristics of gaging stations with records ranging in length from 5 to 87 years. The 10-, 2-, and 1-percent-annual-chance peak flood discharges at several locations on these detailed-study streams were calculated from these regional equations. The 0.2-percent-annual-chance peak flood discharges were calculated using a log-normal extrapolation based on the 2- and 1-percent-annual-chance values.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
York Creek, continued	Confluence with Russian River	Approximately 2 miles upstream of US Highway 101 Southbound	Regional flood-frequency equations	USACE HEC-2 step-backwater	*	AE w/ Floodway	The overbank portions of the cross section data were obtained from topographic mapping (Towill Corporation, September 1979(b)) and digitized ground elevation locations. Those portions of the cross sections located within the limits of the stream channels were obtained by field survey and/or photogram-metric digitization. Bridge plans were used to obtain elevation data and structural geometry for bridges over the streams studied in detail. Bridges and culverts were surveyed where plans were unavailable or out of date. Cross sections for the backwater analyses were located at close intervals above and below structures in order to compute the significant backwater effects of these structures in the developed areas. In long reaches between structures, appropriate valley cross sections were also included in the backwater analyses. WSELs of 10-, 2-, 1-, and 0.2-percent-annual-chance floods were computed for all streams in the study through the use of the USACE HEC-2 step- backwater computer program (USACE, August 1979). Roughness coefficients (Manning's “n") for the streams were chosen to calibrate the results of the computer model to high-water marks from the December 1964 flood (USACE, n.d.(c); USACE, December 1965). The starting water-surface elevations for each of the streams were determined by the slope-area method, an option in the HEC-2 program (USACE, August 1979). In those areas where the backwater analyses indicated supercritical flow conditions, critical depth was assumed for the flood elevations because of the inherent instability of supercritical flow.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
All Sources Mendocino County (Unincorporated Areas)	*	*	*	Approximate Method with HEC-2 backwater computations	*	*	The numerous streams studied by approximate methods were analyzed based on a review of the following information: the Flood Hazard Boundary Map (FHBM) (USHUD, April 1978); the results of HEC-2 computer backwater computations in adjacent detailed-study areas; the floodplain delineations previously developed in the City of Willits FIS (FEMA, September 1988(a)); and high-water mark data gathered by the USACE after the flood of December 1964 (USACE, n.d.(b); USACE, n.d.(c); and USACE, December 1965). Approximate-study results were determined for areas subject to tidal flooding along the Pacific Ocean. The boundary of the 1-percent-annual-chance tidal storm surge was based on the delineation shown on the FHBM (USHUD, April 1978). Areas subject to wave attack are referred to as coastal high hazard zones and are designated as Zone V in this study. The boundary of the coastal high hazard zone in Mendocino County was approximately determined after considering the tidal flood plain boundary shown on the FHBM (USHUD, April 1978) and the methods of wave analysis developed by the USACE (USACE, June 1975). The area of coastal high hazard is that region where a wave of 3 feet or more in height could exist during the 1- percent-annual-chance tidal flood event. The 3-foot wave has been selected be the USACE as the minimum size wave capable of causing substantial damage upon impact to a conventional wood frame or brick veneer structure.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
All Sources Mendocino County (Unincorporated Areas), continued	*	*	*	USACE HEC-2 step-backwater	*	*	For the June 16, 1992 revision, cross-section data for the backwater analysis were obtained from topographic maps from aerial photography compiled by R. M. Towill, Inc., in May 1988, scale 1:2,400, contour interval 2 feet (Phillips Williams and Associates, Ltd., October 1990), and bathymetric maps compiled from bathymetric surveys as a part of channel maintenance dredging conducted by the USACE in August 1975. Geometry of the Highway 1 bridge was obtained from construction drawings for the bridge. Floodplain boundaries were delineated using the R. M. Towill topographic maps (Phillips Williams and Associates, Ltd., October 1990). The Mendocino County (Unincorporated Areas) study was revised on September 30, 1988. Changes were made to reflect changes in the floodplain boundary, floodway, and base (1-percent-annual-chance) flood elevations along Baechtel Creek downstream (east) of the Southern Pacific Railroad crossing. These changes were based on new topographic mapping that is more detailed and more accurate than that used in the original FIS report for Mendocino County. The new data was provided by T.M. Herman and Associates, Willits, California, and consisted of a topographic map of the area east of the railroad crossing, including cross sections 5740 and 6710. This area was field surveyed in September 1986 and April 1987.

Flooding Source	Study Limits Downstream Limit	Study Limits Upstream Limit	Hydrologic Model or Method Used	Hydraulic Model or Method Used	Date Analyses Completed	Flood Zone on FIRM	Special Considerations
All Sources Mendocino County (Unincorporated Areas), continued	*	*	*	USACE HEC-2 step-backwater	*	*	The updated topographic information preceded the effective date of the FIRM (June 1, 1983) and there was no evidence of fill activities in the floodplain. Revised HEC-2 hydraulic computer model analyses utilizing the new mapping were conducted for Baechtel Creek by Aqua Terra Consultants, Mountain View, California, in April 1987.

Table 14: Roughness Coefficients

Flooding Source	Channel "n"	Overbank "n"
Ackerman Creek	0.013 – 0.070	0.040 – 0.180
Anderson Creek	0.013 – 0.070	0.040 – 0.180
Broaddus Creek	0.045 – 0.070	0.090 – 0.120
Davis Creek	0.013 – 0.070	0.040 – 0.180
Doolin Creek	0.013 – 0.070	0.040 – 0.180
East Fork Russian River	0.013 – 0.070	0.040 – 0.180
Eel River	0.013 – 0.070	0.040 – 0.180
Feliz Creek	0.013 – 0.070	0.040 – 0.180
Forsythe Creek	0.013 – 0.070	0.040 – 0.180
Gibson Creek	0.013 – 0.070	0.040 – 0.180
Haehl/Baechtel Creek	0.013 – 0.070	0.040 – 0.180
Hensley Creek	0.013 – 0.070	0.040 – 0.180
Mill Creek (at Willits)	0.013 – 0.070	0.040 – 0.180
Mill Creek (at Redwood Valley)	0.013 – 0.070	0.040 – 0.180
Mill Creek (near Talmage)	0.013 – 0.070	0.040 – 0.180
North Fork Mill Creek	0.013 – 0.070	0.040 – 0.180
Noyo River	0.030 – 0.035	0.035 – 0.120
Orrs Creek	0.013 – 0.070	0.040 – 0.180
Robinson Creek	0.013 – 0.070	0.040 – 0.180
Russian River	*	*
Tenmile Creek	0.013 – 0.070	0.040 – 0.180
Town Creek	0.013 – 0.070	0.040 – 0.180
York Creek	0.013 – 0.070	0.040 – 0.180

*Data Not Available